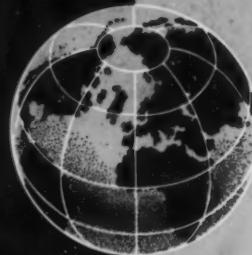


JANUARY 1957

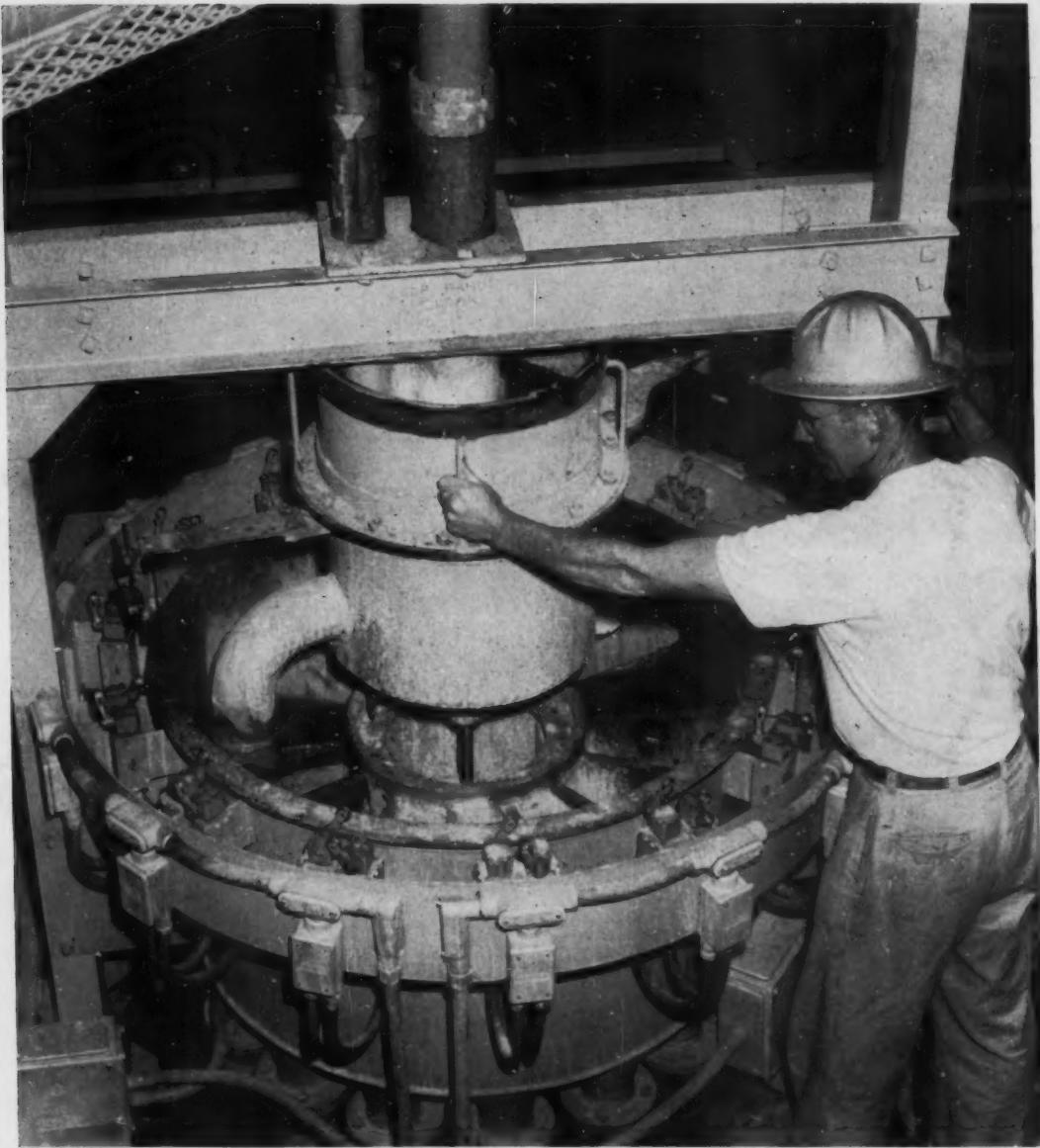
Vol. 19 No. 1

MINING WORLD



North Carolina Copper
Mining Page 44

What To Expect In 1957
Mining Page 48

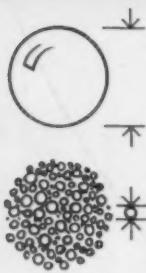


Mines Development's New Uranium Mill

Page 36

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Intense, efficient aeration of Wemco-Fagergren rotor-stator mechanism produces larger number of smaller bubbles giving maximum mineral attachment surface.

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In recent, rigorous testing with top-notch competitive equipment, Wemco Fagergren Flotation Machines proved best in recovery, grade, floor space, cost and maintenance — as the following test results indicate:

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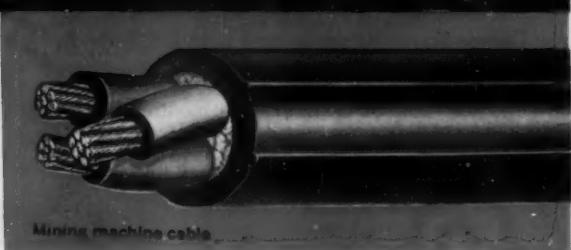
Power knife for cutting costs

Coal cutters, and all other powered mining equipment, such as loaders, feeders, shuttle cars and drills, work toward the one big goal of safer, more economical production. Simplex-TIREX cords and cables are helping to achieve this goal in mines everywhere. They offer maximum flexibility, and their jacket of cured-in-lead Neoprene Armor resists abrasion, oil, heat and water, and gives longest life.

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Wire sculpture by Henry Szafarz

Simplex
TIREX



Mining machine cable

Clearing the way for ore —where the going's really tough!



This is a mine haul road on Forest Service land about a dozen miles out of Lowman, Idaho. A CAT* No. 12 Motor Grader maintains 22 miles of it for Hi Dayley of Boise, under contract to Porter Bros. Corp.

Porter Bros. own two dredge mines near Bear Valley, working rare earths—uranium, monazite, titanium and other minerals. They need this road 12 months of the year. It's always a rugged maintenance job for the No. 12—mountainous, sandy, rocky. But this photo was taken in May, and during the winter the temperature dives to 56° below and the snows level off at around 11 feet. Still the No. 12 clears the way for the ore haul, day in, day out. When the snow is deep, the Domor Snow Blower is used to move the snow well back from the roadside.

The Cat No. 12 is a tough, smooth-working machine, made for rough duty like this. Its new oil clutch means better, easier operation and considerably less

maintenance. Its controls are mechanical: fast and positive. It can swing that long-life blade from ditch cut to bank cut in less than a minute, without link adjustment. It features convenient in-cab starting, excellent visibility (notice the operator sitting down) and many other advantages. Its powerful 115 HP Cat Diesel Engine runs smoothly and faithfully on low-cost non-premium fuels.

For full details on the No. 12—product of the world's largest manufacturer of motor graders—see your Caterpillar Dealer. See him, too, for expert service, and for replacement parts you can trust.

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U. S. A.

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Mining World

Including the Export Edition WORLD MINING

Published monthly except in April when publication is semi-monthly

VOLUME 19

JANUARY 1957

NO. 1

OPERATIONS-TECHNOLOGY

Milling

How Mines Development Mills Black Hills Uranium 36

By STANLEY DAYTON

A group of virtual "unknowns" put the nation's eleventh uranium mill in operation at Edgemont, South Dakota. Using the resin-in-pulp process, a relatively high tonnage per man-shift is obtained through the use of a number of engineering controls among which are: automatic control of leach pH at any desired value; a RIP section designed without valves and which signals solution flow as well as bank arrangement for loading and stripping cycles.

Mining and Milling

Copper Mining Revived in the Carolinas 44

By A. E. ROBERTS

Appalachian Sulphides, Inc. has reopened the historic Ore Knob copper mine in North Carolina and built a new 700 ton per day mill scheduled to go into operation this month. Last production was in 1885. Surface diamond drilling since 1953 has outlined 1,330,300 tons of 3.0 percent copper ore which will be mined by Appalachian.

Industry Review

Big Events in 1956 Mining With a Preview of 1957 48

By GEORGE O. ARGALL, JR.

In 1956 metals shifted from scarcity to abundance, Anaconda's Berkeley pit was Open Pit Mine of the Year; San Manuel's new copper mine was the Underground Mine of the Year; Rare Metals Corporation of America was Small Mining Company of the Year; and Ambrosia Lake and new milling contracts highlighted uranium. For 1957 there will be many significant metallurgical developments and new plants in uranium, iron, copper, bauxite and other metals.

Foreign Mining

Why Greater Development of Latin American Mines Needed Now 53

By CHARLES WILL WRIGHT

Suez Crisis and shipping difficulties for mineral imports focus attention on Latin America as the source of strategic minerals for the United States. Chile and Peru have done much to encourage United States investments. Ways and means to encourage development of Latin American minerals are outlined.

Convention

Northwest Mining Association Holds 62nd Convention 56

Miners hold two day convention in Spokane, Washington with responsible men in industry urging increased emphasis on research in the years ahead. Northwest Mining Association favors some revision of General Mining Laws.

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ON THE COVER

Outstanding feature of Mines Development's new uranium mill is a valveless distribution system designed by Western-Knapp Engineering Company for the RIP section. The cover photo shows Peter Zeimet operating the pneumatic control of a distribution wheel through which IX feet and eluate enter the RIP banks.

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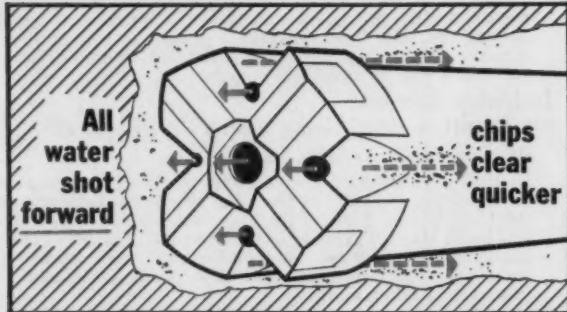
For air-leg drills and light stoping...

New TIMKEN® removable bit has tapered socket for more secure union



With its uniformly tapered socket, this new Timken® bit provides a more secure union between bit and steel for feed leg drills. And it reduces bit breakage, permits quick and easy bit changes. The bit body is made of special analysis Timken electric furnace fine alloy steel—with the finest in physical properties obtainable in a rock bit today.

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New features speed chip removal—Five specially positioned front holes direct water more forcefully against face, wash away chips faster. Deeper, wider clearance between cutting wings works in conjunction with 5 front holes to give speedier removal of washed-back chips. The new features of the Timken tapered socket bit speed drilling, give lower cost per foot-of-hole.

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Your most economical bit for ordinary ground. With correct and controlled reconditioning, it gives the lowest cost per foot-of-hole when full increments of steel can be used. And it is interchangeable with Timken threaded carbide insert bits on the same drill steel.

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For other tough drilling jobs. New design features speed chip removal. 1) five front holes; 2) deeper, wider clearance between wings; 3) deeper undercut under the heel. Improved thread contact reduces breakage. New wear-resistant carbides add life.



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Drifts and Crosscuts

Defense Department's Domestic Minerals Program?

The mining industry is waiting for the promised long-range domestic minerals program of the Department of the Interior with mixed feelings. Secretary Seaton and other high officials have definitely stated that early this year the program will be submitted to the 85th Congress. Many industry observers believe that the Department can't come up with anything really new, while others believe that the program will be of so little actual help to many miners that it will be of questionable value. Still others believe that the program will be good, will be immediately workable, and that mining will be accelerated.

The industry hopes that the Department of Interior has been working on the program in conjunction with the Office of the Assistant Secretary of Defense for Engineering. The engineering office in a recent report stated that . . . "Costs of materials must rise. Foreign sources will grow less assured." Undoubtedly the most significant part of the report stated that to meet mobilization goals, and to fulfill full mobilization [war] demands, the turn will be increasingly toward domestically available materials. "Only thus can we preserve the health and capacity of industry for the long-range future, whether in peace or war."

Industry, of course, includes mining in this instance.

Here are the basic elements for a long range minerals program. The Department of Interior can do much to implement them.

Is Your Mine In The Directory?

Work has already started on compilations of MINING WORLD'S Annual Directory of Major United States Mining Operations. This Directory is a key component of the Annual Yearbook printed in mid-April and used all during the year by the mining industry as the leading reference book.

More than 4,000 questionnaires have already been sent to mining companies requesting the latest information about their operation and the names of key personnel.

The mining industry is constantly changing and no directory is ever completely accurate. Accordingly, your mine may have been unintentionally missed. So, if you are a new mine operator, or if your mining operation was inadvertently omitted from last year's Directory, here's your chance for a free mine listing. Please fill in the form at the bottom of page 104 and mail it directly to MINING WORLD.

COMING CONVENTIONS

February 7, 8, and 9, 1957. National Western Mineral Conference and 60th Annual Convention of the COLORADO MINING ASSOCIATION, Shirley Savoy Hotel and Mile High Center, Denver, Colorado.

March 3 through 6. Silver Anniversary Convention of the PROSPECTORS AND DEVELOPERS ASSOCIATION, Toronto, Canada.

March 3rd through 9th, 1957. Joint meeting AMERICAN SOCIETY OF PHOTOGRAVEMETRY and AMERICAN CONGRESS ON SURVEYING AND MAPPING, Shoreham Hotel, Washington, D. C.

March 11 to 15, 1957. ATOMIC EXPOSITION AND NUCLEAR CONGRESS, Convention Hall, Philadelphia, Pennsylvania.

April 5, and 6, 1957. PACIFIC SOUTHWEST MINERAL INDUSTRY CONFERENCE, sponsored by the Nevada, San Francisco, and Southern California sections of the AIME, Reno, Nevada.

April 16, 17, 1957. HIGH TEMPERATURE MATERIALS CONFERENCE, Cleveland Section of the AIME, Hotel Carter, Cleveland, Ohio.

May 28, 29, 1957. SECOND REACTIVE METALS CONFERENCE, Southern California Section of AIME, Ambassador Hotel, Los Angeles, California.

Caterpillar announces NEW HEAVY-DUTY RIPPERS

No. 4 No. 6 No. 8 No. 9
for CAT* Diesel Tractors
and Traxcavators*

- Ruggedly constructed to rip in extremely tough conditions—hardpan, shale, asphalt, frozen ground and other stubborn materials!
- Utilizes weight of tractor for positive ripping action at any depth of tooth penetration.
- Close mounted for excellent maneuverability in cramped quarters!



No. 6 Ripper with No. 977 Traxcavator Three teeth standard with provision for two extra. Parallel linkage for same cutting action on all teeth at any depth. Cutting width— $82\frac{1}{2}$ "; ground penetration—down to 16"; length behind tracks (raised) — $29\frac{1}{2}$ ". Also for use with D6.



No. 9 Ripper with D9 Tractor Three teeth standard. Ripping action is versatile—use one, two or three teeth. Any or all of them can be swung up and pinned out of the way. Teeth pivot 10° to either side. Cutting width—106"; ground penetration—down to 28".

No. 8 Ripper for use with D8 Tractor. Two teeth standard—designed to handle a third tooth. Individual tooth control as on No. 9. Cutting width—92"; ground penetration—down to 26".

No. 4 Ripper for use with D4 Tractor and No. 955 Traxcavator. Three teeth standard with provision for two extra. Parallel linkage. Cutting width—71"; ground penetration—down to 12".

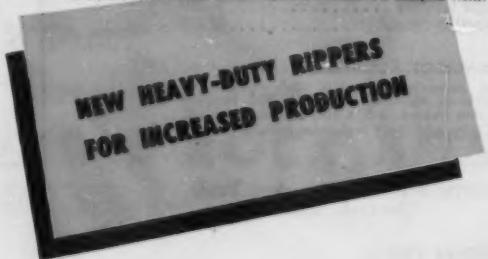
Here's a tough new line of rippers developed by Caterpillar to increase the versatility of rugged yellow Cat Diesel Tractors and Traxcavators. They come equipped with alloy steel teeth with replaceable tips. Their special design and sturdy construction enable you to handle jobs that were previously considered impractical because of difficult digging conditions.

They're one more example of Caterpillar's "leadership in action" policy to produce equipment that helps you do more work at lower cost. For complete information about them, see your Caterpillar Dealer!

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U. S. A.

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Capitol Concentrates

SEC Tries To Tighten Rules To Slow Venture Capital Flow To Mining

The gradual encroachments made by the Security and Exchange Commission on the treatment of Regulation A issues is of great concern to those who wish to see venture capital flow into small mining enterprises.

It will be remembered that when the law was first passed, the limit for these small issues was \$100,000. The intent was that there would be a minimum of expense and red tape to the issuer. All that was supposed to be necessary was to put out a brief prospectus which told the buyer the naked truth, palatable or otherwise. That the Congress was quite satisfied with this state of affairs is illustrated by the fact that under the Vandenburg amendment the exemption was raised to \$300,000.

Now the SEC is trying to tighten up the rules to the point where, many brokers say, it will be as difficult to qualify under Regulation A as under the regular registration method. No doubt the late uranium boom in penny stocks is responsible for the new SEC proposals, but the trend has been obvious for many years. It appears that the latest proposed regulations are unnecessarily stiff and it may well be that legislation will be required to prevent this shutting off of venture capital.

• Testimony Given On Mine Safety Bills

Representatives of the Bureau of Mines and the Public Health Service, testifying before the Metcalf Subcommittee of the House Education and Labor Committee on the mine safety and silicosis bills, seemed to indicate definitely that the safety situation in metal and non-metallic mineral mines is very good in comparison with conditions in coal mines. Testimony from the Public Health Service indicated that silicosis of recent years is not too important a problem, and that even in the cases that have turned up in the last few years, factors not completely understood may be involved, rather than a direct dust problem. It also was shown rather clearly that no reliable comparative statistics between state and industries are available, in spite of a number of exhaustive surveys which have been made recently.

• Tungsten Producers Face New Difficulties

The rapid exhaustion of the money allocated by the Interior Department for the purchase of domestic tungsten is somewhat of a mystery. The 5,000 unit per producer limitation, together with the lowered price per unit, was calculated by Assistant Secretary of the Interior Wormser to cut domestic production in half, and there has been no time to put new properties into production.

The Interior Department, it will be remembered, justified a total appropriation of \$91,000,000 to carry out the purposes of Public Law 733, the Mineral Purchase Act. Congress passed a supplemental appropriation of \$21,000,000 which was designed to

carry the programs into January of 1957 when the balance of \$70,000,000 could be put into a regular appropriation bill. On the basis of the tungsten program progress to date it would appear that the purchase of the entire 1,250,000 units authorized by the Congress will be completed long before the termination date in the law and probably before the tungsten industry as a whole can put itself on a self-sustaining basis. Undoubtedly this means future agitation for an amendment to Public Law 733 to increase the number of units to be purchased.

• Silver Attack Is Continued

An article by retired Admiral Donald J. Ramsey on the domestic silver situation appeared in the *American Metal Market*, November 24, 1956. It shows how tenacious the Silver Users Association is in attempting to repeal the Silver Purchase Act. Among the economic gems that Ramsey propounded is the following: "Silver money is cheapened money, and to print money whose value is not guaranteed but which fluctuates with the market price is most certainly unsound."

Mr. Ramsey's article would seem to bear out the old Navy tradition that an admiral, when on his year's shore duty, is capable of anything, be it running a laundry, a steel mill, or the country's economic policy.

• Fluorspar Producers Protest GSA Ruling

An example of how the government agencies can ignore a plain mandate from the Congress is found in the new fluorspar regulations. It may be noted that Public Law 733, Sec. 2 (c) says, among other things, that acid-grade fluorspar shall be purchased f.o.b. carriers conveyance "at producers' milling point." The idea was to equalize small mines whose mills are some distance from a railroad siding with large mines which in many instances have sidings next to the mill and not penalize producers some distance from a railroad as the base price of \$53.00 per short dry ton was set by the law.

Instead of interpreting "carriers conveyance" to mean a truck, it is being interpreted as a railroad car, which means the trucking cost has to be paid by the producer. It is understood that the Fluorspar Producers Association is making vigorous protest to GSA and the Interior Department in an attempt to get this interpretation revised.

• Positive Proposals Are Needed

S.J. Res. 148 of the last Congress, on which hearings were not held, instructed the Secretary of the Interior to come up with a plan and with a draft of legislation which would keep the domestic mining industry in a favorable economic position and maintain a satisfactory mobilization base. Considering the Suez situation, it is to be hoped that Secretary Seaton will develop something positive rather than the pale palliatives of the report of the President's Mineral Policy Committee.



George Atchison (left), engineer, and J. G. McVay, superintendent, with Caterpillar-powered Vulcan locomotive owned by Lone Star Cement Co. of Jackson, Ala.

TORQUE CONVERTER SMOOTHNESS + DIESEL FUEL ECONOMY = BIG SAVINGS FOR LONE STAR

Lone Star Cement Co. of Jackson, Ala., installed Caterpillar D318 Torque Converter Power Units in two 12-ton Vulcan locomotives, replacing gasoline engines with conventional transmissions. Let J. G. McVay, superintendent, tell the story: "With these CAT* Diesels, we've gotten away from a lot of costly transmission repairs and maintenance. And we used to burn 22 gallons of gasoline in an eight-hour shift. Now we use only 10 gallons of fuel oil per eight hours—a big saving to us."

The two locomotives make 40 to 45 round trips per day over the two-mile track from pit to loading conveyor. They haul six cars, each loaded with seven tons of limestone and clay, up a two per cent grade. A Caterpillar Engine with torque converter is ideal here. Engine power is smooth and oil-cushioned, moves off with big loads quickly, and climbs grades without shifting.

The Caterpillar D318 is a 137 HP (maximum output capacity) diesel that operates on money-saving, non-premium furnace oil. Thanks to its four-cycle design, there are no cylinder ports or air boxes to clean. And its large-orifice, Caterpillar-built fuel injection system means that the engine will not foul, even when idling for extended periods. With such Caterpillar features as "Hi-Electro" hardened cylinder liners and crankshafts, aluminum-alloy bearings and highly effective oil, air and fuel filters, this rugged yellow engine is built to stay on the job and out of the shop.



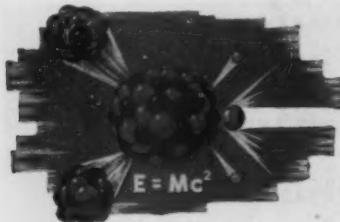
There's a full line of Caterpillar Torque Converter Power Units up to 650 HP (maximum output capacity). Leading manufacturers can supply mining equipment with Caterpillar power. And your Caterpillar Dealer can install a Cat Diesel if it's time to repower. Discuss your engine needs with him soon—and count on him whenever you need skilled service or parts you can trust.

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U.S.A.

CATERPILLAR*

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MODERN
HEAVY-DUTY POWER



FISSION FACTS

Monthly Roundup of Mining News
In the Atomic Energy Field

Why Solvent Extraction Is Used In New Uranium Mills

The uranium milling trend is to solvent extraction. This was highlighted by Texas Zinc Minerals Company when it switched from RIP to solvent extraction during construction of its mill at Mexican Hat, Utah scheduled for operation late this year.

To obtain the background on solvent extraction and why the process was gaining favor MINING WORLD asked Jesse C. Johnson, director, Division of Raw Materials, United States Atomic Energy Commission, for a special report on this new process. Here are highlights of this report:

"The Commission has sponsored development work on this technique for quite some time and it is very gratifying to see the results turn out as favorably as we had expected when we started the program. While we recognize that solvent extraction may not be the universal process for uranium extraction, it holds definite promise in many cases of high recoveries and lower operating costs. This is evidenced by the fact that several commercial uranium mills are now employing this technique and others are giving it serious consideration. The potential savings by the use of solvent extraction over the ion exchange process, also developed under Commission sponsorship, may not be as spectacular as the savings we incurred by the first use of ion exchange over conventional techniques previously employed. Nevertheless, due to the tremendous increase in tonnage processed, the dollar values of these savings could well be substantial.

"The principle of solvent extraction has been known to the chemical industry for many, many years. Because of its highly successful application throughout other activities of the AEC, the Process Development group of the Division of Raw Materials strongly believed that the technique could be adapted to recovery of uranium from ores. It was the encouragement that the Process Development group of the Division of Raw Materials transmitted to the various laboratories under its jurisdiction which provided the initiative and incentive that eventually enabled these scientists and engineers to successfully develop a solvent extraction technique for uranium bearing ores.

"The Dow Chemical Company had been investigating the use of ion exchange resins to recover uranium from phosphoric acid made from Florida phosphate containing small quantities of uranium. This work did not prove successful and it was suggested to Dow that they switch their emphasis to the use of organic solvents. Since the uranium existed in a phosphoric medium, the Dow investigators reasoned that it might be possible to discover a complex phosphate compound that was immiscible w/ phosphoric acid that would have an affinity for uranium, since the complexing characteristics of uranium were well known. As a result of a systematic investigation of this approach it was discovered that octyl pyrophosphoric acid diluted with kerosene would extract uranium from solution. This process is in operation today at several plants in Florida.

"We then encouraged the Dow Chemical group to investigate the application of this technique to conventional type ores. The discovery of octyl pyrophosphoric acid led to an investigation of a whole family of esters of long chain organic alcohols and phosphoric acid. Several have been developed which will work on sulfate leach liquors from conventional ores. All of this work was done at the Pittsburg, California Laboratory of the Dow Chemical Company under the direction of Dr. Richard Bailes.

"About this time a group at Oak Ridge National Laboratory started investigating the long chain hydrocarbon phosphate family and have successfully developed new extractants. In addition, the Oak Ridge group, under the direction of Keith Brown, also came across a family of amines which have very good uranium recovery properties.

"The Dow Laboratory at Pittsburg did not have suitable facilities to test out this solvent extraction technique on conventional ores on a larger scale. It was therefore decided that a pilot plant operation would be sponsored by the AEC at the Salt Lake City, Utah Bureau of Mines under the direction of Bruce Clemmer. The Bureau of Mines worked very closely with the Dow group in developing this process on a larger scale.

"Some of the advantages of solvent extraction technique over other methods of recovering uranium are as follows:

- (1) Possibility of lower operating and capital costs.
- (2) Efficiency of recovery of uranium—sometimes 99.5+ percent of the solubilized uranium.
- (3) Flexibility of a liquid-liquid system, rather than solid-liquid system of ion exchange.
- (4) The ability to set up a true continuous countercurrent extraction system.
- (5) We now have a wide variety of suitable extractants, each one having different advantages and disadvantages. One can select the extractant which most suits his particular problem.
- (6) The possibility, with certain modifications, of producing a uranium oxide or uranium fluoride of reactor grade purity.
- (7) Ease of stripping—less likelihood of loss of solvent due to poison as could happen in ion exchange system.

"Most of this work has been done on the recovery of uranium from clear pregnant acid leach liquor. Our development activity is now directed toward the recovery from slurries. These slurries range from desanded pulps containing 5 to 7 percent solids, to high density, up to 60 percent solids. The principle problem encountered in this development work is the entrained loss of solvent.

"We hope that as a result of our activity in this field that others will find application of solvent extraction in the recovery of other metals from various complex ores. Because of the success we have had we certainly feel that this would be a profitable field of investigation."

IN CALIFORNIA . . . AND THE WORLD OVER

**Bucyrus-Erie Electric Shovels Cut Costs
where they start . . . in the pit**



A Bucyrus-Erie 6-cu. yd. 150-B is shown here removing overburden in a California open pit iron mine.

Big-output capacity plus month-after-month dependability are advantages that enable Bucyrus-Erie electric shovels to help hold down costs. In busy iron mines everywhere, these machines are helping owners cut costs with such outstanding advantages as:

1. Modern front-end design that combines light weight with great strength.
2. Sturdy construction, from boom point to treads, that saves maintenance and adds to life.
3. Ward Leonard variable-voltage control which permits rapid acceleration and deceleration and assures plenty of extra torque and power when it's needed.

Follow the lead of successful owners the world over — put a Bucyrus-Erie electric shovel to work keeping output high and costs low. You can choose from three models — the 4½-yd. 110-B, the 6-yd. 150-B, and the 8-yd. 190-B.

8315AC



BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN



when teeth lose
their "bite"



It's a 15-MINUTE REBUILDING JOB with Amsco® Cast-to-Shape Repointers

**Easy to weld on... add
strength and service
life to entire tooth**

Where dipper-tooth wear is moderate, and where digging conditions are not too severe, Amsco Cast-to-Shape Repointers provide a cost-saving answer to tooth replacement.

An average-size tooth can be completely rebuilt in about 15 minutes. The repointer overlaps

the tooth top and bottom and is easily welded in place, using only a few electrodes.

Cast of Amsco Manganese Steel, with "ears" that protect the flat sides of the tooth, these repointers add strength and service life to the entire tooth. Available as individual repointer units, or in bar lengths.

For heavy digging, use Amsco "Wear-Sharp" Repointers or Repointer Bars. Order Amsco Repointers from your nearby Amsco Distributor.



AMSCO

American Manganese Steel Division • Chicago Heights, Ill.
OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS; JOLIETTE, QUEBEC
Distributed in Canada by Canadian Liquid Air Co., Ltd.

*The Bowling Champ
buys a custom-made ball
because he gets
something **EXTRA***



**the profit-wise operator
BUYS TRAYLOR
ROTARY KILNS
for the same reason**

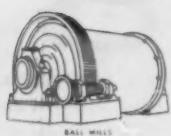
Chances are Traylor has already Traylor-made a Rotary Kiln quite similar to the one best suited for the most efficient, profitable thermo-processing of your particular product. Sizes have been built from the smallest up to 12' in diameter and 450' in length. Bulletin No. 11-121 will give you complete details and specifications, write for your copy today.

TRAYLOR ENGINEERING & MFG. CO.
902 MILL ST., ALLENTOWN, PA.
Sales Offices: New York—Chicago—San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

the experts agree . . . there's nothing like

TRAYLOR-MADE

equipment for peak performance



BALL MILLS



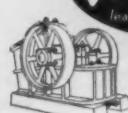
ROTARY KILNS



PRIMARY GYRATORY CRUSHERS



APRON FEEDERS



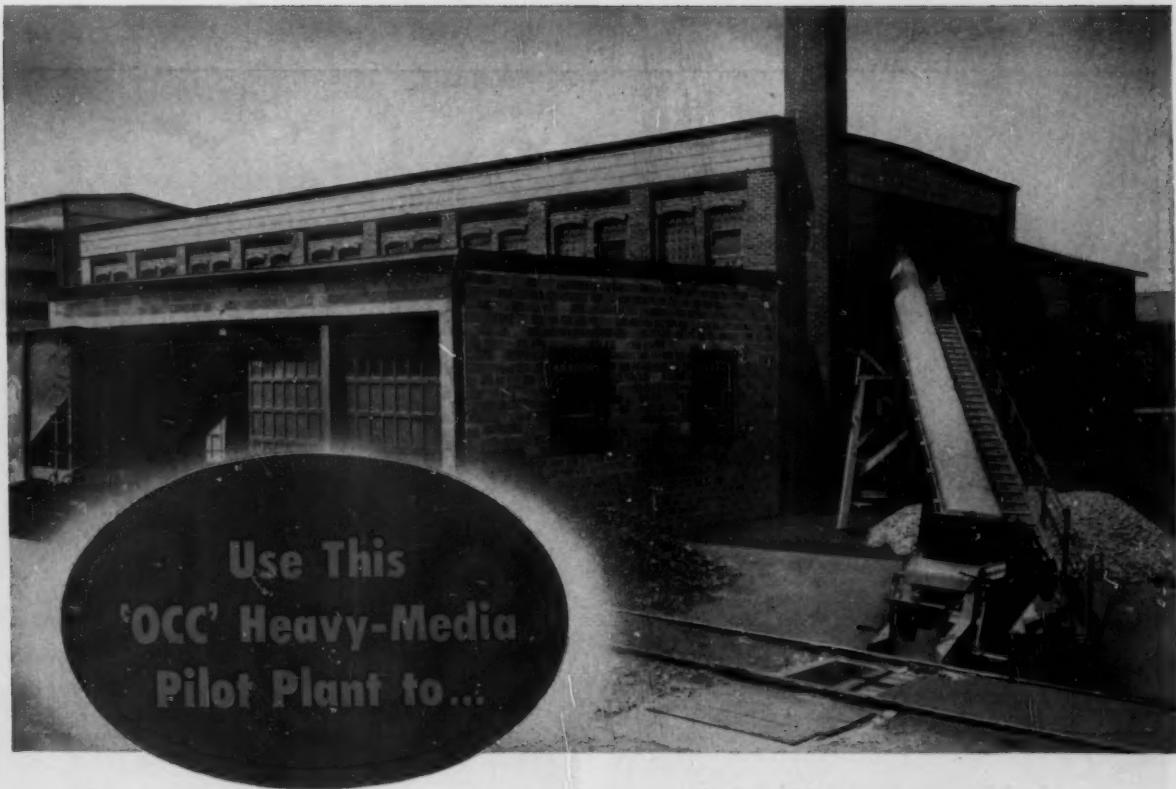
JAW CRUSHERS



SECONDARY GYRATORY CRUSHERS



MINING WORLD



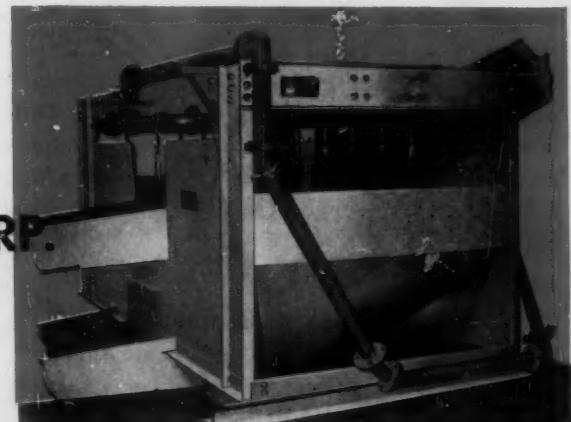
- help you spell out your separating problems
- predetermine yield & efficiency of new equipment

If you are planning new heavy-media equipment or plant, we believe you will find OCC's complete pilot plant and laboratory services of inestimable help. At the White Haven, Pa., plant pictured above you can see a commercial-size OCC Vessel treating truck or carload quantities of your feed. Samples will be taken in your presence and prepared for final product assay. In short, this OCC service enables you to confirm laboratory test results on a full operating scale and to determine yield and efficiency factors before you invest in equipment.

We invite you to join the increasing number of mining men who are visiting our pilot plant. We will be pleased

to have you see in operation our complete, full-size HM system employing an OCC separatory vessel. This OCC unit has set entirely new standards of design, operating simplicity and metallurgical efficiency.

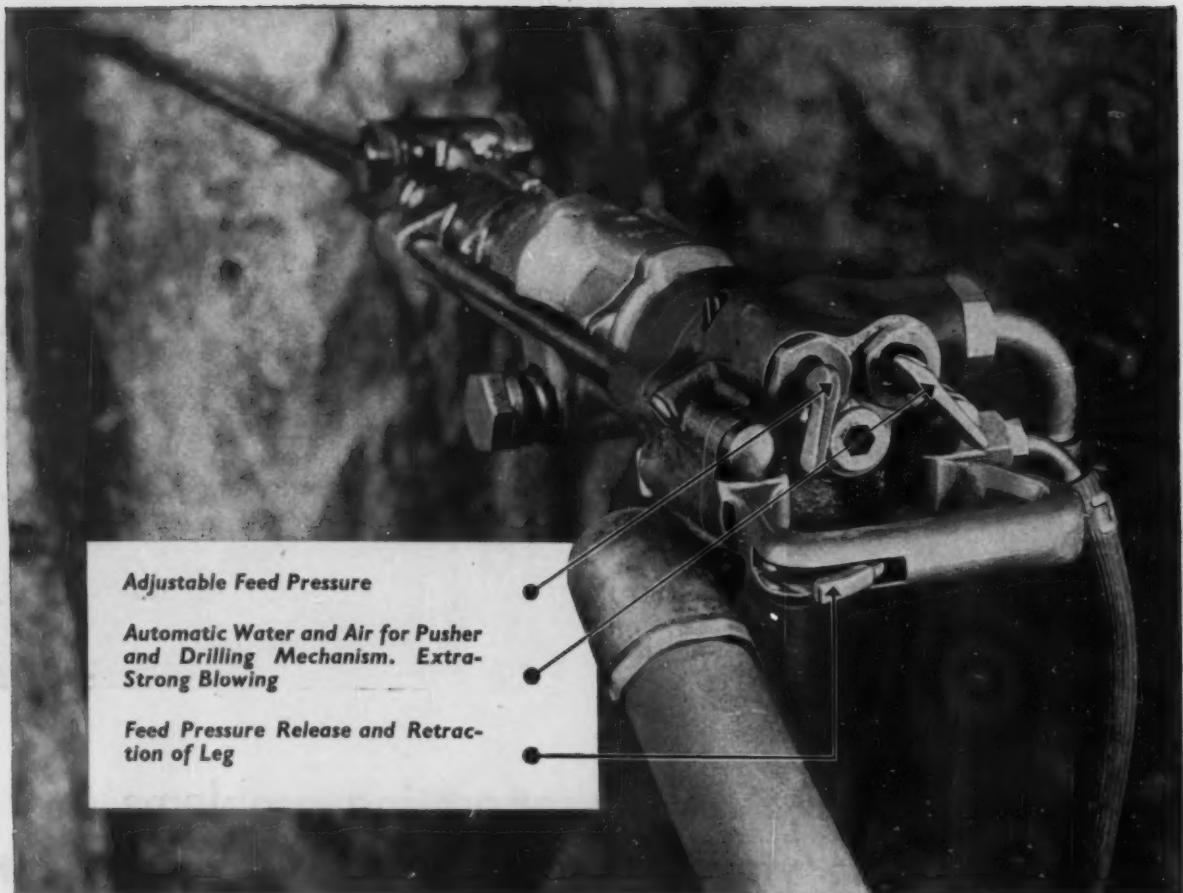
Below, OCC Heavy-Media Vessel: float and sink discharges on left, feed chute on right. U. S. and foreign patents.



The ORE & CHEMICAL CORP.

DIVISION: MINING AND MILLING MACHINERY
80 BROAD STREET, NEW YORK 4, N. Y.





RETRACTABLE LEG AND ONE-HAND GRIP-CONTROLS SPEED DRILLING TIME

For years Atlas Copco have been the world's largest manufacturers of pusher leg drills. Since 1937 when Atlas Copco, far ahead of any other manufacturer, introduced their first pusher leg drills, they have continuously improved the design of these drills. Their latest development, the Atlas Copco 'Lion', combines an unequalled ease of operation together with a high drilling rate—both contributing to a higher footage per manshift.

All controls under one hand

The Atlas Copco Lion is the first drill to have all the valves which operate the drill under the control of one hand. *Full control without having to move the hand from the backhead!*

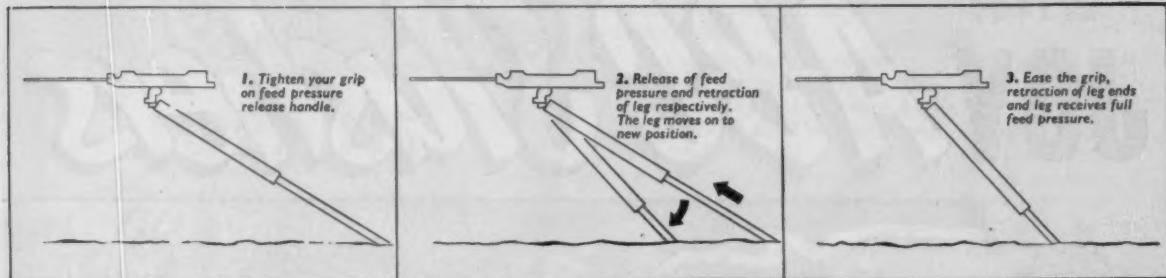
The valves are all easy to operate. By the use of only the fingertips the drill can be started or shut off, the feed can be adjusted to the pressure required, or retracted for an advance, and the extra air-blowing can be brought on to clean the holes.

All the control handles have been designed in such a way that they are well protected. While using them the operator's hand is never near the wall or roof of the drift. The Lion is the first pusher leg drill with controls placed for drifting.

Retractable leg saves time

When the leg has to be moved the feed pressure is easily released by squeezing the hand grip. By further pressure on the grip the leg retracts automatically.

Pusher leg moves forward with drill in full action



When the leg is in the new position suitable for continuous drilling, retraction stops and the feed pressure comes back by loosening the grip of the hand. *All this can be done while the drill is still running.*

This new idea of a retractable leg enables quicker repositioning of the leg and reduces the number of steel changes, thereby increasing footage per manshift. When drilling high holes it is now far easier to alter the position of the leg more frequently in order to maintain an optimal feed angle and feed pressure.

Packed with power for deep holes

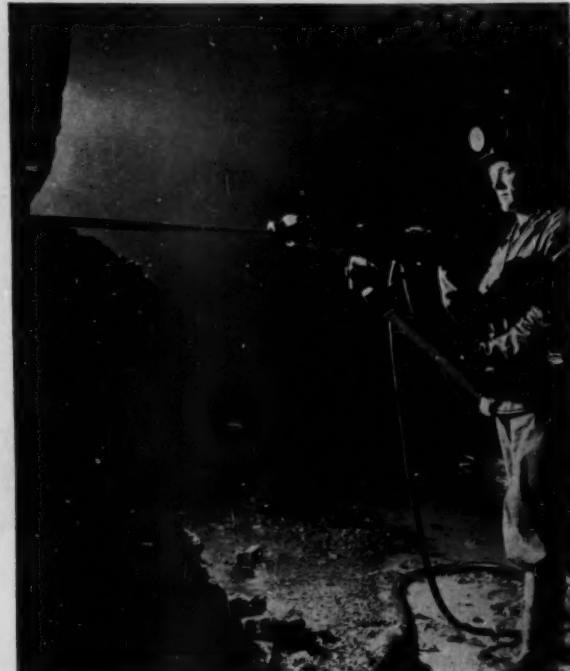
The Lion has a drilling rate at least 30% higher than other rock drills of the same weight. Furthermore, it is designed so that it can maintain its high speed even when drilling deep holes. This means quickly drilled deep hole rounds and a faster, steadier advance. You'll also find that the Lion reduces to a minimum the gauge wear of the bits in abrasive rock. And owing to the ease with which the feed pressure is released and brought back into action, the Lion is a handier drill to work with in fissured rock.

Sandvik Coromant—the right steel for the Lion

All Atlas Copco drills—and this goes for the Lion—have been developed from the earliest stages with Sandvik Coromant tungsten-carbide-tipped integral steels and detachable bits. No drill or steel developed separately could ever give such equivalently high performances as this drilling combination. It is today the most widely used in the world, responsible for drilling more than one billion feet per year.

Free Demonstration! Wire, 'phone or write today to any one of these offices and see the *Atlas Copco Lion* in action for yourself.

U.S., Atlas Copco Pacific, Inc., 930 Brittan Avenue, San



Without changing the grip of the hand the driller can easily position and control the machine, saving time and reducing fatigue.

Carlos, California. Atlas Copco Eastern, Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA, Atlas Copco Canada Ltd., Montreal Airport, P.Q.

MEXICO, Atlas Copco Mexicana S.A., Apartado 56, Torreon, Coahuila.

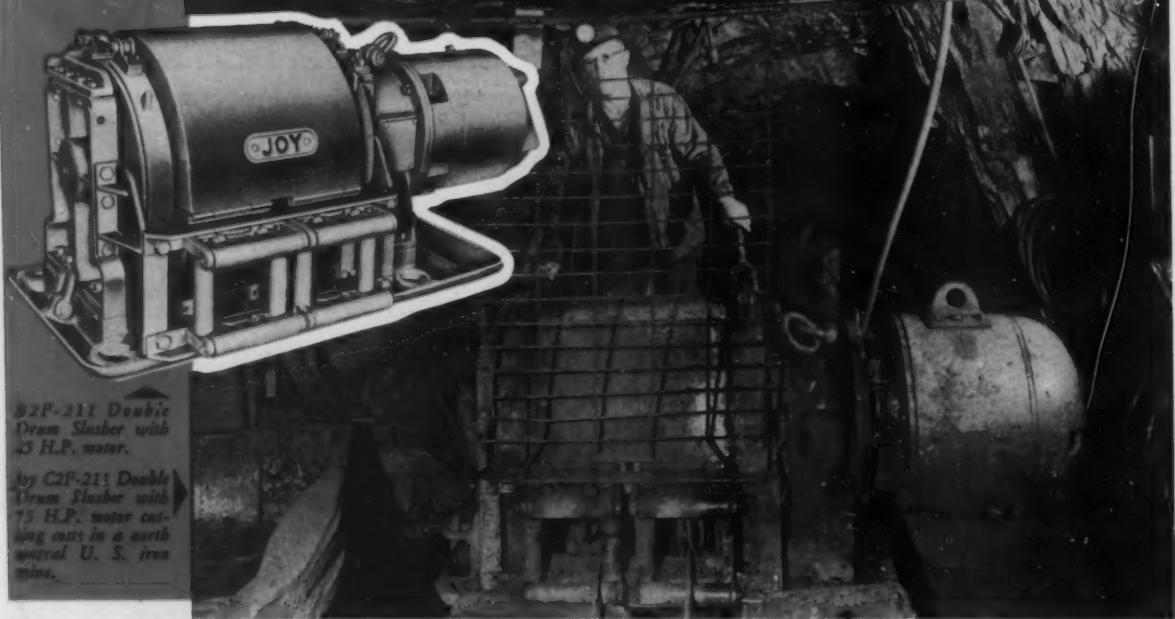
The ATLAS COPCO GROUP puts compressed air to work for the world. It is the largest group of companies specializing solely in the development and manufacture of compressed air equipment. It embraces Atlas Copco companies or agents manufacturing or selling and servicing Atlas Copco equipment in ninety countries throughout the world.

Atlas Copco

D551

Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment

**HAUL ORE AND ROCK AT LOWEST COST
WITH
JOY A-B-C Slushers**



Joy B2F-211 Double Drum Slusher with 5 H.P. motor.

Joy C2F-211 Double Drum Slusher with 75 H.P. motor cutting costs in a north central U. S. iron mine.

The A-B-C's of low cost scraping are not learned in school—you learn them in the field. Joy A-B-C slushers, A2F, B2F, and C2F, two and three drum, have demonstrated, in mine after mine, their ability to haul at rock bottom cost. It's not hard to learn why.

Joy A-B-C slushers operate at lower cost because clutches are bigger and wider for longer life—for longer intervals between adjustment and relining. Rugged construction with one-piece rigid base keeps all working parts in perfect alignment. Large drum diameters give longer rope life. A-B-C slushers reduce operator fatigue because their clutches are 100% self-energizing.

For simple, low-cost maintenance Joy A-B-C slushers have only one grease fitting per drum . . .

to service each drum's planetary gear train. Grease reservoirs adjacent to shielded type ball bearings provide lubrication as needed. Clutch bands and adjusting nuts are out in the open, easily accessible for adjustment and relining.

These are just some of the cost saving features built into the Joy A-B-C line. They are available with flange mounted electric or air motors from 10 to 75 H.P.

Why not find out more about the A-B-C's? Write to Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

WBW-M-6244-121



Write for FREE Bulletin 121-8

Consult a Joy Engineer

for AIR COMPRESSORS, ROCK DRILLS, CORE DRILLS,
HOISTS and SLUSHERS, MINE FANS AND BLOWERS

JOY

WORLD'S LARGEST MANUFACTURER OF
UNDERGROUND MINING EQUIPMENT

DOWN BELOW... (or up on top)

LORAINS make money mining gypsum

This is a scene in an underground gypsum mine, where a Lorain-25 Scoop Shovel with a 1 1/4-yd. bucket is loading shot rock. Designed with a telescopic horizontal type boom for low headroom operation, the Lorain maneuvers with ease in the underground rooms that are 40' wide and 16' high. The current Scoop Shovel output of 750 tons in 7 3/4 hours, is limited only by available hauling units. The material weighs 3,000 lbs. per cu. yd. This large, national gypsum mine operates two Lorain Scoop Shovels, both of which can be con-

verted to conventional 3/4-yd. shipper shaft shovel front ends for surface mining.

The Lorain Scoop Shovel is another example of Lorain engineering applied to the special needs of mining men.

The horizontal crowding action of the bucket is usable below grade, at grade or at elevated positions. The extra-long stroke and reach of the telescopic boom enable the Scoop Shovel to work a wide radius from one spot. The floor can be "cleaned-up" easily. The turntable can swing a full 360° to dig and load directly from face to trucks. The high maintenance of constant moves is eliminated.

The Lorain Scoop Shovel is but one of many popular Lorains that are making money for miners today... conventional shovel capacities range from 3/8 to 2 1/2 yd. class... crane capacities from 7 to 75 tons... plus draglines and clamshells for any type of excavating or material handling. For information about Lorain Scoop Shovels—or any other Lorain to fit your needs—ask your Thew-Lorain Distributor for a job visit.

Get this booklet — Free!

Get your copy of this booklet picturing numerous Lorain Scoop Shovel applications, with data and specifications. Ask your Thew-Lorain Distributor for copy, or write to us direct.



Far below the ground, a Lorain Scoop Shovel loads shot gypsum rock for a large, national gypsum mine. The Scoop Shovel solves the low headroom problem—does its job with few moves.



THE THEW SHOVEL CO., LORAIN, OHIO

THE
LORAIN®



Michigan Model 175A owned by E. J. Petrillo, Inc., sold and serviced by United Tractor and Equipment Corp., N. Y. C.

Four-yard crawler-loader not available . . .

So Petrillo loads oversize blast rock with this 2½-yd. Michigan

This photograph shows a section of E. J. Petrillo's contract on the New York Thruway where the contract called for removal of an old granite quarry. Petrillo used one of his 2½-yd. Michigan Tractor Shovels to load out oversize blast rock. Some of the rock weighed as much as 6½ tons and measured close to 8 ft. wide.

Unusually tough assignment

Superintendent Tony Tangredi said that the job normally would have called for a 4-yd. crawler-loader, but the crawler-loader wasn't available. So he decided to try the Michigan, even though he considered this an unusually tough assignment for a

rubber-tired machine. During the three weeks the Michigan was on this job, its performance was satisfactory in every way.

Drives job-to-job at 27 mph

Petrillo's Michigans are always on the move—loading trucks in the borrow pit, handling general clean-up work all over the job. "A big advantage to us is the maneuverability of these Michigans", says Supt. Tangredi. "At 27 mph, they get where they're needed in a hurry—and you don't need trailers to move them. On this rock-handling job, we proved that the Michigans will handle the tough assignments along with the routine jobs."



Note the size of the stones being loaded into the rear-dump.

Try it on your work

Like E. J. Petrillo, Inc., more and more owners have found that a Michigan will handle jobs which have always been considered too tough for rubber-tired Tractor Shovels. The exclusive Clark power-train—torque converter, power-shift transmission and planetary wheel drive axles—gives the Michigan more useable power and traction than you've ever seen on this type of machine. Your Michigan distributor would like the chance to prove it. Ask him to demonstrate on one of *your* tough jobs—you name it.

Michigan is a registered trade mark of

**CLARK®
EQUIPMENT**

**CLARK EQUIPMENT
COMPANY**
Construction Machinery Division
2493 Pipestone Road
Benton Harbor 15, Michigan

Above: **Low-level bucket action** gets a heaping load of oversize rock. Note that the bucket is not even fully "closed"—the full tip-back arc is 40 degrees. The clean design of the Michigan bucket mechanism preserves the dumping clearance over truck sideboards.

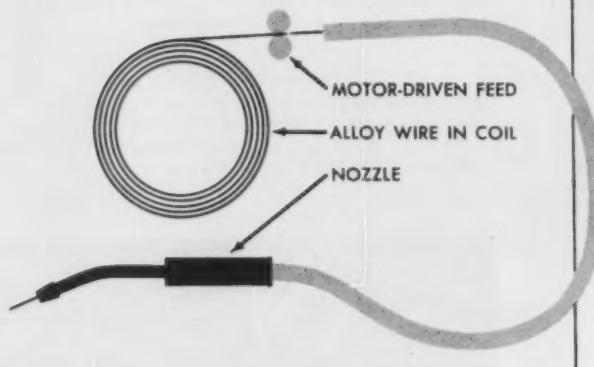
Left: **Loading a rear dump**, the Michigan demonstrates fast dumping action. When the operator steps on the brake, the power-shift transmission automatically goes into neutral—puts the full engine horsepower into the bucket hydraulic system.

Below: **Good visibility** for the operator as he actuates the low-level tip-back. The Michigan Model 175A has 133 hp, power steering, 4-wheel power-braking, torque converter and power-shift transmission as standard equipment.



WHAT IS SEMI-AUTOMATIC HARD-FACING?

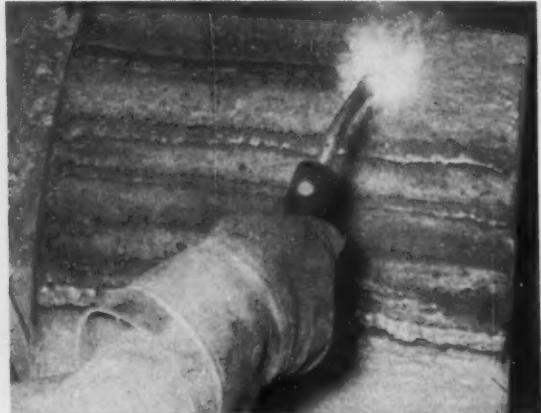
Here is one of industry's newest maintenance tools used to radically reduce hard-facing costs. It is simple, highly versatile and can be installed at moderate price.



Semi-automatic hard-facing is a process which combines the high deposit rates of automatic welding with the positioning and setup convenience of the manual method. It utilizes a complete series of Stoody fabricated tubular wires containing alloys that meet all hard-facing requirements. These wires, supplied in layer wound coils, are mechanically fed to the nozzle by the semi-automatic welding machine. The weldor merely directs the arc as the metal is deposited on the work, the machine automatically starting the wire feed when the arc is struck, stopping it when the arc is broken. Numerous advantages result when rebuilding and maintaining equipment in all types of heavy industry.



Repainter welded on with Stoody Nickel Manganese and entire tooth hard-faced with Stoody 121



Roll brought up to size with Stoody Nickel Manganese and corrugations rebuilt with Stoody 100

HIGH WELDING SPEEDS—Two to four times faster than the manual method at correct welding amperages, semi-automatic hard-facing effects enormous savings in time. Penetration of the base metal and dilution of the deposit are reduced, with lower heat input, all highly desirable features of this process.

FULL VISIBILITY—No submerging flux is required; the weldor enjoys complete visibility of the weld at all times. Flux dams are unnecessary.

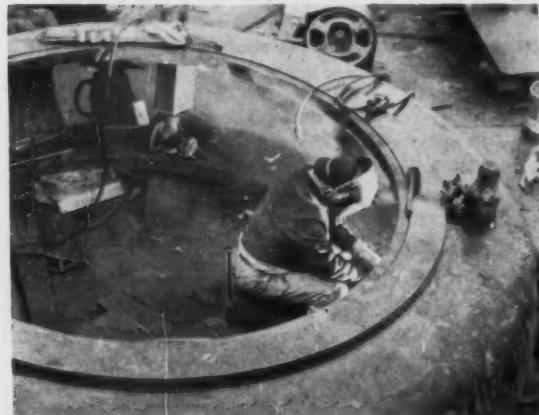
NO STUB END LOSSES—Wires are supplied in continuous coils. There is no stub end waste nor time lost in changing electrodes.

SEMI-AUTOMATIC MACHINES—Now supplied by a number of manufacturers, all can be used satisfactorily with Stoody semi-automatic wires with minor conversions consisting of wire guides, nozzle and nozzle tip. Conversion kits are available from all Stoody distributors.

WHERE CAN SEMI-AUTOMATIC HARD-FACING BE ECONOMICALLY USED?—In general, almost any work now hard-faced manually can be completed faster and cheaper semi-automatically with deposits having wear resistance usually superior to manual electrodes of similar analysis. The illustrations are typical of current semi-automatic applications.

Write for circular. Contains a full description of present Stoody semi-automatic wires and typical applications.

Available from your Stoody dealer.
Check the "Yellow Pages" of your phone book
or write direct.



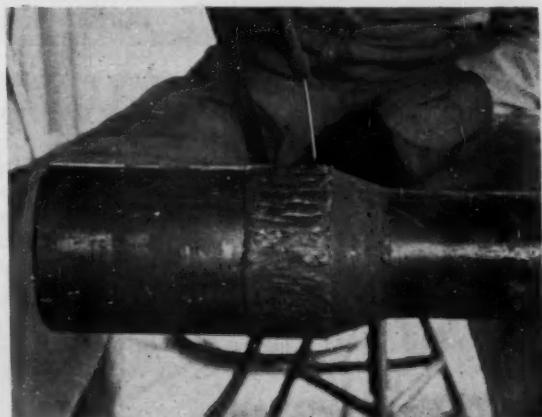
Dredge pump casing hard-faced with a combination of Stoody 121 and Stoody 100



Shovel track pads rebuilt with Stoody Nickel Manganese



Mill hammers brought up to size with Stoody Nickel Manganese, using copper form, then hard-faced with Stoody 100



Tool joints hard-faced with Stoody 130 or Stoody 100

STOODY COMPANY
11969 EAST SLAUSON AVENUE
WHITTIER, CALIFORNIA

PERFORMANCE DEPENDABILITY

HUBER-WARCO 7-D Motor Grader



torque converter • power-shift transmission

Tough grading assignments are met quickly and efficiently with the 140 h.p. Huber-Warco 7-D motor grader. The perfect balance of weight and power, plus torque converter and power-shift transmission, handles a larger volume of work with fewer passes.

A tail-shaft governor automatically adjusts engine RPM to meet load conditions, at any ground speed set by the operator. Other performance features include: completely hydraulic cab-controlled blade

movement; power sliding moldboard; elimination of a foot clutch and many more.

Other Huber-Warco torque converter graders are: 6-D (100 h.p.), 6-D2 (125 h.p.), 7-D2 (150 h.p.) and 5D-190 (195 h.p.). Models with standard transmission include: 4D-75 (75 h.p.), 4D-85 (85 or 93 h.p.) and 4D-115 (115 or 123 h.p.). This complete grader line offers a size for every job.

For a demonstration—see your nearest Huber-Warco distributor



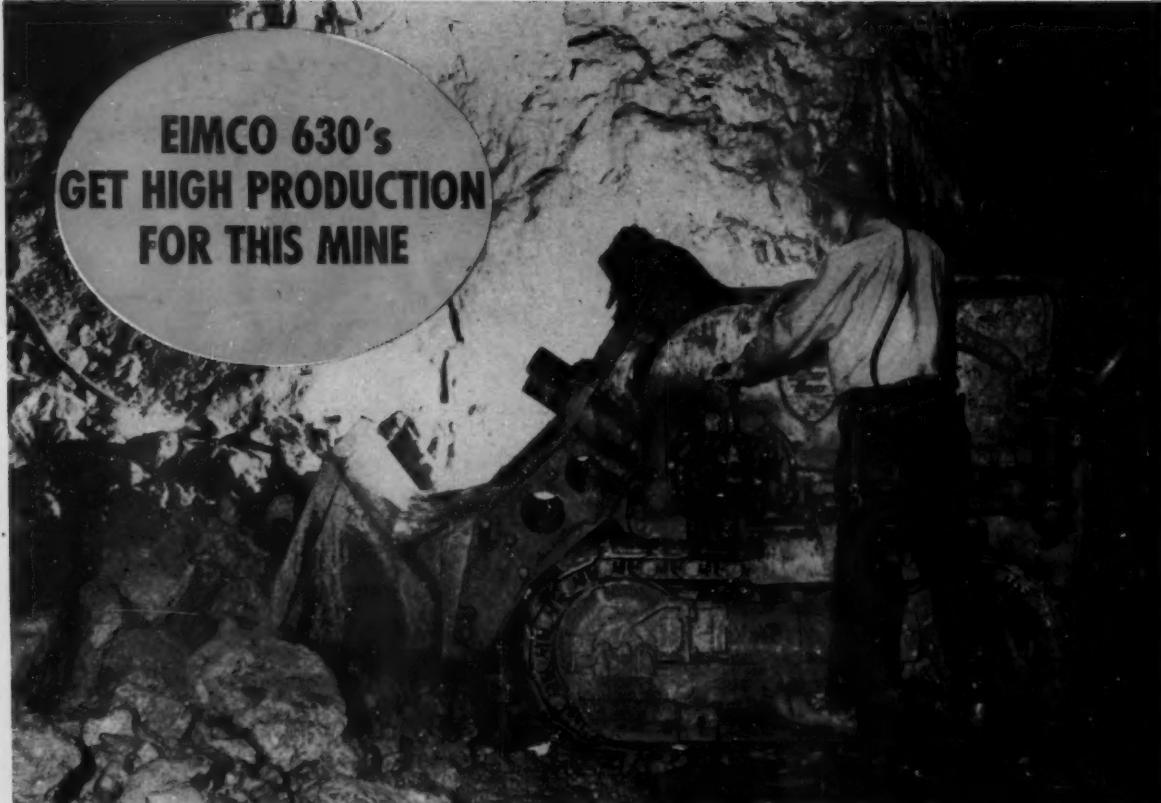
HUBER-WARCO COMPANY

MARION, OHIO, U. S. A.

CABLE ADDRESS: HUBARCO

Road Machinery

ROAD ROLLERS • MOTOR GRADERS • MAINTAINERS • GRINDERS



EIMCO 630's GET HIGH PRODUCTION FOR THIS MINE

At a large lead zinc mine in Missouri, two Eimco 630 Crawler-Excavators are demonstrating the profitable advantages of trackless mining, cutting tunnels to ore pockets in a shaft 1,000 feet below surface.

Seeking to combat ever-increasing production costs while meeting a growing demand for lead in critical applications, officials of this mining firm planned the operation around a trackless system. This has proven a sound economic move.

The two Eimco 630's took over development tasks from another type of trackless equipment early this year. They have provided these results:

High operating efficiency. Sharp (independent track) maneuverability; quick response to easy-to-work levers; rugged . . . stay on the job under severe service; high mobility . . . no restrictions on movement.

Cycle time saver. The 630's can go right to work on a muck pile . . . require no preparatory measures. Powerful crowding action quickly fills the big bucket and rocker arm discharge is fast.

Lower initial investment. Cost is about one-fourth as great as that of previously used equipment.

The Eimcos are helping to make it profitable for this company to extract lead from lower grade ore.

This versatile machine was not developed overnight. It has evolved from a long period of close association with the mining industry and a constant alertness to production problems.

See the 630 in action. You'll agree, it will allow you to capitalize on expanding opportunities in an industry where volume excavating at low cost is becoming increasingly critical to a profitable operation.

Leading big trucks, this operator uses his left hand to regulate tractor movement and his right hand to control the bucket as the 630 crowds a muck pile.



THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A.

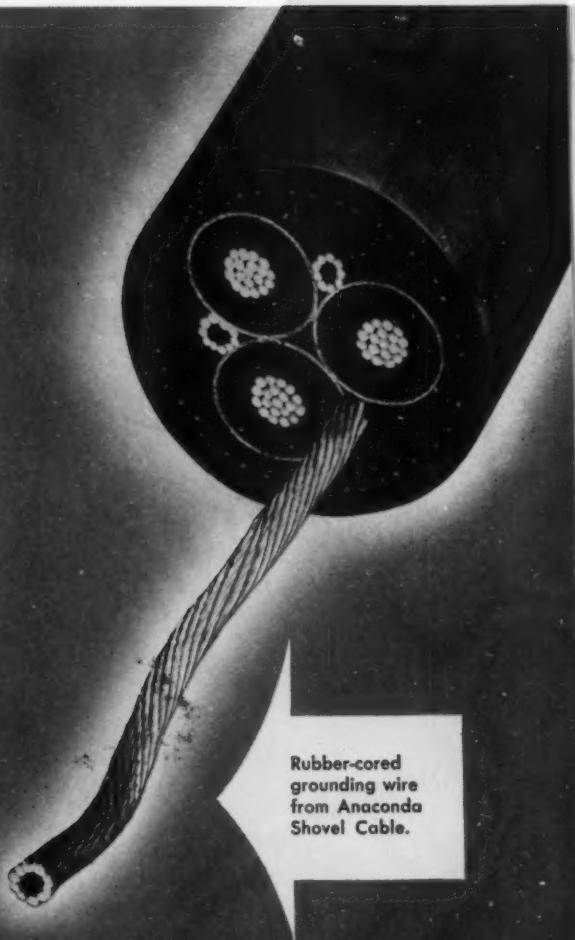
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Standard grounding wire from ordinary shovel cable.



Rubber-cored grounding wire from Anaconda Shovel Cable.



PHOTOGRAPH of grounding wires from actual cables. Note how wires in ordinary shovel cable have kinked and broken in service — while Anaconda's patented rubber-cored grounding wires show no sign of damage.

Look how Anaconda's rubber-cored grounding wires

keep cable on the job and out of the shop

When shovel cable is moved in mining operations, ordinary grounding wires tend to move within the cable—to kink and break during bending, as the actual sample on the left shows.



LARGER DIAMETER of Anaconda's rubber-cored grounding wire; unlike ordinary grounding wire, will not cut insulation if cable is crushed (diagram 1). In addition, it provides broader contact with the shielding, provides a more positive ground (diagram 2).

In contrast, Anaconda's patented rubber-cored wires, right, conform more readily when compressed or bent. Every wire in every strand is cushioned. No kinks or breaks occur.

Rubber-cored grounding wires also have larger diameters—this provides (1) broader contact and shielding and (2) reduces tendency of the ground wires to cut the individual wires in both the shield and the grounding wire.

The only shovel cables made with rubber-cored grounding wires are made by Anaconda. For more information, call the Man from Anaconda or see your Anaconda distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Patented by Anaconda

ASK YOUR **ANACONDA®** DISTRIBUTOR
ABOUT SHOVEL CABLE

56302



NEW EIMCO FILTER DESIGNS PAY OFF FOR THIS CUSTOMER

In the past decade, a prominent firm has increased considerably its production of Titanium Dioxide—a pigment used extensively for paint and whitening applications from "centres to doorknobs".

During this period, an Eimco Disc-Type Filter has been employed in the flotation process used on ilmenite concentrate.

The ilmenite flotation concentrate is 60% solids with fast settling physical characteristics when fed to the Eimco Filter. Filtered concentrate is immediately shipped by rail to other plants where it is a raw material for the production of titanium dioxide, used to whiten and brighten thousands of products.

Working in close alliance with a co-operative client, Eimco's field engineers recommended new methods that achieved high operating efficiency as production level increased.

When filtering rate was increased, the disc filter—as a result of the expansion—was taxed far beyond the production capacity it was intended to maintain. At this high production level, an ordinary disc filter

was not capable of maintaining uniform particle suspension, resulting in uneven cake formation, low capacity and higher-than-necessary moisture content (15%).

By converting the disc filter into an Agidisc—strong, properly directed agitation was applied and uniform particle suspension was attained. The Eimco Agidisc readily handled the concentrate under process conditions imposed by this increased volume . . . produced even cake formations dewatered to 8% moisture.

Later Eimco "Hy-Flow" Design was applied to the Agidisc. This streamlined design permits the flow of filtrate and air through the filter and valve with a minimum of hydraulic resistance. Filtering capacity has increased, vacuum loss reduced and cake is dewatered to 6.2% moisture.

The search for a better way never stops at Eimco's Research and Development Center, Palatine, Illinois. The result is a constant flow of improvements in filtration equipment that pay off in increased production and more profit. Write today for more information.

THE EIMCO CORPORATION
SALT LAKE CITY, UTAH

Research and Development Division, Palatine, Illinois
Export Offices: Eimco Building, 31-32 South Street, New York 5, N. Y.

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

Process Engineers Inc. Division, San Mateo, California



B-335

NEW TEAMWORK IN DIESEL ENGINE DESIGN AND PRODUCTION

Two great names—American MARC and Hallett—join forces to guarantee still greater value and efficiency in the design and production of an All-American line of the finest small Diesel engines.

Already, a new and larger plant is under construction to greatly accelerate the mass production of American MARC Diesels. The most advanced machine tools will assure the ultimate in quality control and standardization. New models are planned to maintain and advance the proud position of the Company as the American leader in the low-power, lightweight, air and water cooled Diesel engine field.

If you need a reliable, lightweight, full-Diesel for industrial or marine application—or as a prime mover of powered equipment—write for literature. American MARC's small size, low cost, modern Diesel engines will certainly appeal to your sense of value.

AMERICAN MARC INC. ENGINES OF QUALITY

1601 West Florence Ave., Box 549, Inglewood, Calif. • Telephone OR.8-7174

SOME desirable sales territories are still open.

Inquiries are invited from representative dealers.

- ★ Air or Water Cooled; 5.5 to 25 hp
- ★ All-American, from basic materials to completed engines
- ★ Available as portable power units, generating plants, pumping units, or for marine propulsion

6-101



Model WC-1,
one-cylinder,
water-cooled,
4-cycle, 6 HP
@ 1800 RPM.
Wt.: 220 lbs.



Model A1Q-3KW,
one-cylinder,
air-cooled,
4-cycle, 3KW
@ 1800 RPM.
6.7 HP



Model AC-2,
two-cylinder,
air-cooled,
4-cycle, 14 HP
@ 1800 RPM.
Wt.: 350 lbs.



Model AC-1,
one-cylinder,
air-cooled,
4-cycle, 6 HP
@ 1800 RPM.
Wt.: 220 lbs.

Eimco 105 Front End Loader

With 40,000 lb.

Breakout Power



In broad usages such as loading in mines where low ceiling prevents overhead discharge . . . razing brickwork in open hearth furnace slag pockets . . . cutting smooth grades where fine control is required . . . loading into haulage equipment where high discharge is necessary . . . loading into light units or handling fine, dusty and wet material where controlled discharge is desirable . . . loading around wharves, docks, railroad yards (with fork lift attachments) . . . the 105 fills industry's requirements for a rugged, extra heavy-duty front end loader.

NOW! EIMCO HAS TWO RUGGED LOADER ASSEMBLIES

Productive scope of the Eimco 105 Crawler-Tractor has been broadened again by development of a heavy-duty Front End Loader.

For the first time, this provides the earth-moving industry with a machine that can utilize two unique loading attachments . . . each employing entirely different operating principles for jobs where physical conditions make the use of one advantageous over the other.

Since introduction of the 105, heavy construction industries in all parts of the world have praised the digging and loading speed of Eimco's rugged Rocker Arm Excavating Loader.

Like this and all Eimco equipment, the Front End Loader reflects years of constant development combining research with practical field experience.

Exclusive features of the hydraulic system provide an extra margin of protection against mechanical delays and the torque converter transmits maximum power from engine to boom and bucket cylinders for powerful digging effort at the bucket lip.



EIMCO 105 EXCAVATOR

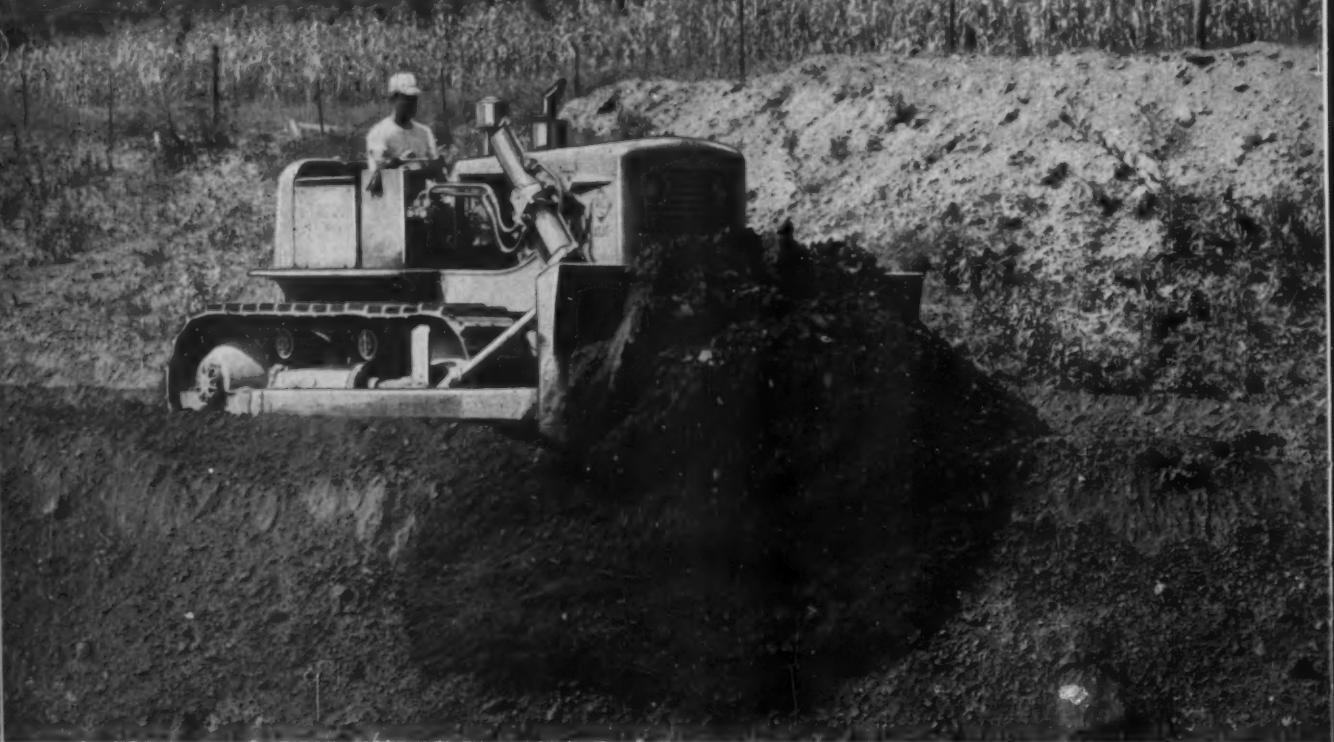
All attachments (including bulldozer assemblies) are Eimco-built to standard SAE mounting dimensions for the basic 105 Tractor. This means that you get extra performance from every attachment through operating ease, maneuverability and visibility . . . permits you to increase your earning potential without the addition of specialized machinery.

Each of these dirt-moving tools gives you new production and profit opportunities well worth investigating. Do this today by writing The Eimco Corporation for full particulars.

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ALLIS-CHALMERS ADVANCED DESIGN *turns waste time into work time*

You get *extra* money-making *work time* with an Allis-Chalmers crawler tractor on every job—dozing, winching, towing, pushing. Built for today's jobs, these crawlers are wheeling out more work in less time than comparable size machines.

Look at the facts

1,000-hour lubrication intervals save lube time

Allis-Chalmers tractors start the day with go—not greasing. You can operate six months on a 40-hour week basis with just one lubrication of truck wheels, front idlers and support rollers. Designed with Positive Seals and tapered roller bearings, these units are protected from dust, loose sand, soft ground, mud or water. You not only gain *working time*, but save labor and lubricant costs as well.

Modern shift pattern speeds digging

Here's a big timesaver on dozing work. It takes just half the time and effort to change from low forward to fast reverse with the Allis-Chalmers HD-6, HD-11, or HD-16 transmission. One simple shift of the gear lever does the job. You gain production time — up to 25 percent on actual test — on jobs calling for a short forward-backward cycle.

Unit construction cuts servicing time

No need to remove transmission or engine, radiator, grille, when servicing or removing an Allis-Chalmers master clutch. This unit can be removed without disturbing adjacent parts. This is also true of other main assemblies — final drive gear, transmission, steering clutches, engine and truck frame. As a result, hours of *costly service and downtime* are saved because of Allis-Chalmers advanced design.

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Get the complete story from your Allis-Chalmers construction machinery dealer

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Now...the completely new

Forward Control 'Jeep' FC-150

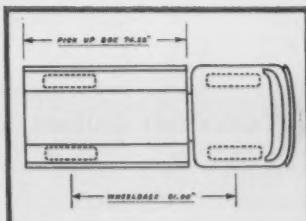
- **New Forward Control design**
- **Maximum cargo space on minimum wheelbase**
- **"Go-anywhere" maneuverability**
- **Famous 'Jeep' ruggedness and economy**
- **4-wheel-drive traction and versatility**

Meet the world's newest, most exciting 4-wheel-drive Truck. New Forward Control design is the secret!

It's the first time a 4-wheel drive truck has so effectively combined outstanding maneuverability with so much cargo capacity! This newest truck concept puts a 74" pickup box on an 81" wheelbase to give you record-breaking cargo space per inch of wheelbase.

The new 'Jeep' FC-150 gives you safety-tested big-truck features with traditional 'Jeep' stamina and versatility. This newest addition to the famous 'Jeep' family, retains all the rugged, versatile, functional features you'd expect to find in any 'Jeep' vehicle.

Ask your 'Jeep' dealer for an on-the-job demonstration!



New Forward Control Design places the engine behind you, puts every inch to work, gives you up to 200% greater visibility.



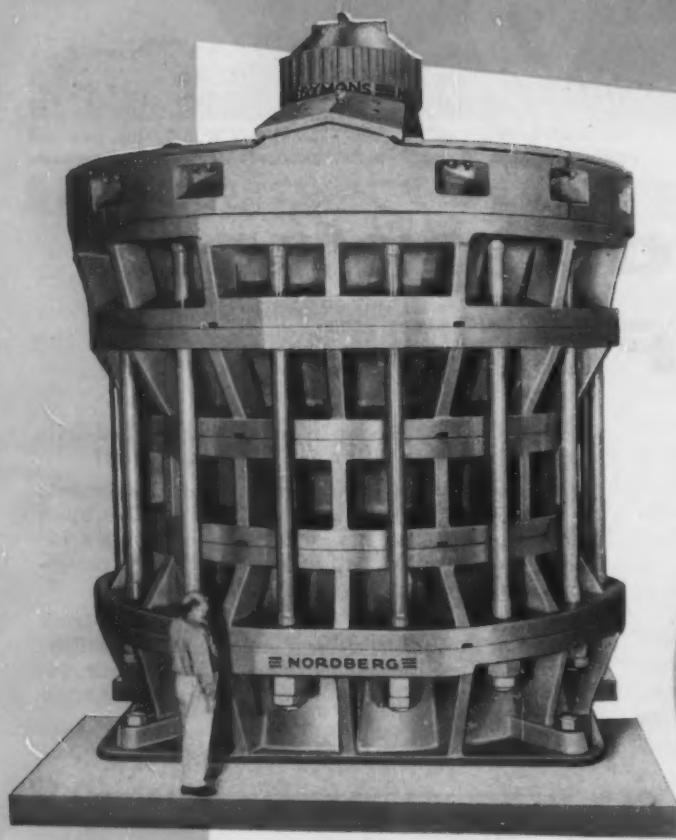
New Safety-View Cab is extra roomy, has largest wrap-around windshield in the FC-150 weight class.



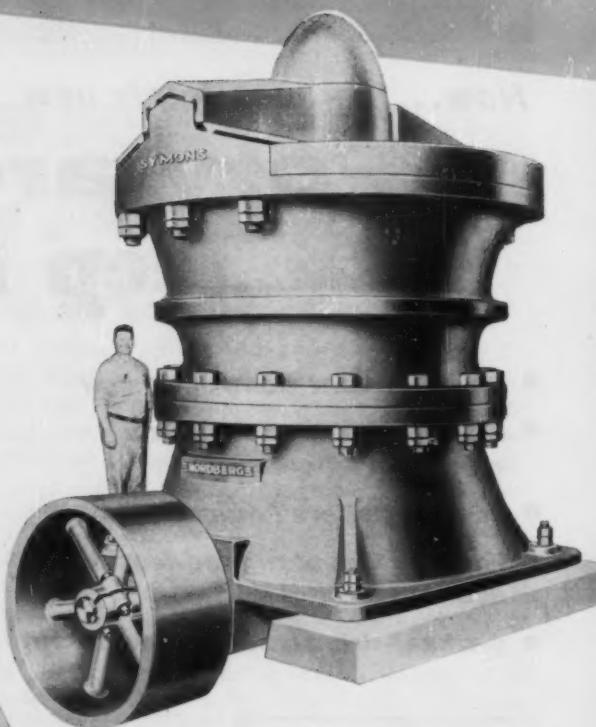
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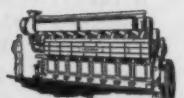
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6 to over 3500 tons per hour

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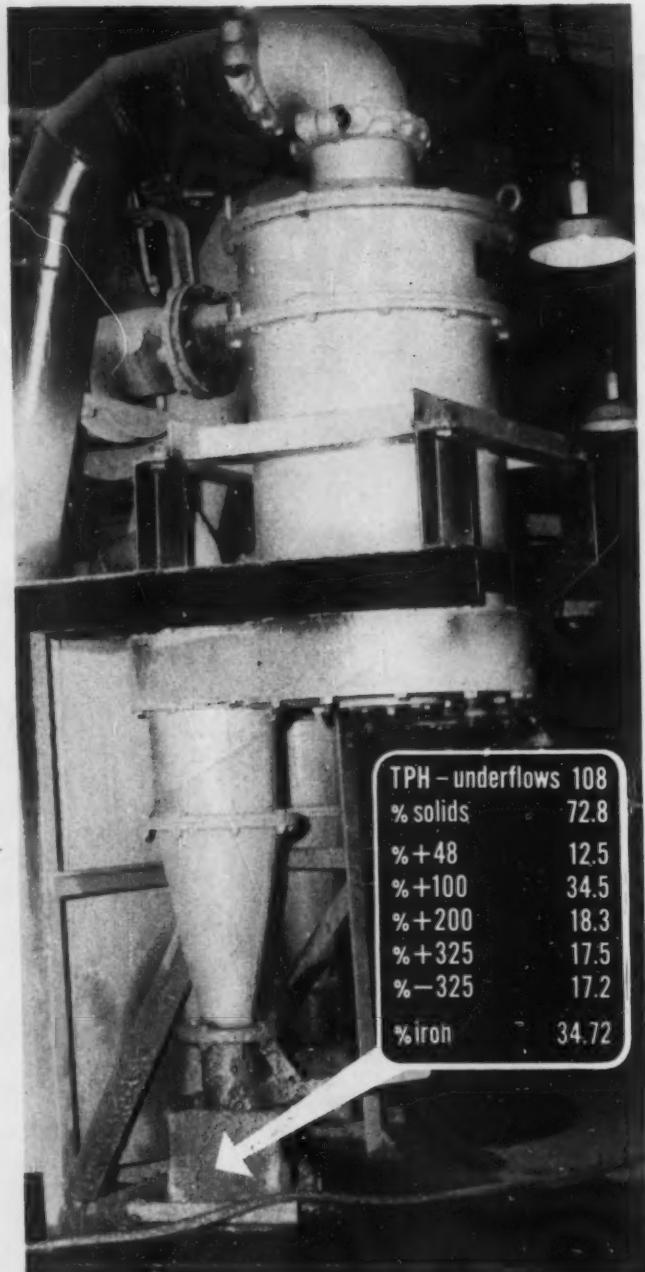
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technique
for recovery
of values
from tailings**

A new economical method for additional recovery was developed in 1954 at this Mesabi Range iron ore beneficiation plant by the use of Krebs Cyclones. A battery of 10 Model EE20-9B integral two stage Krebs Cyclones* handles 5840 gpm (281tph) with the primary overflow rejecting paint slime and the secondary overflow rejecting fine sizes high in silica and low in iron. This is an exceptionally sharp split. Upgrading from 20.75% Fe to 34.72% Fe into crystalline sizes makes an ideal feed for the subsequent concentration to required grade.

This recovery technique has now been adopted by 14 other iron plants throughout the world and has also been applied to tailings from plants handling ores of chrome, manganese, copper, lead-zinc, tin, tungsten, gold-silver.

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"Mexican gold-copper operation treating 550 metric tons per day had been using methylamyl alcohol at rate of 0.5 lb. per ton. Phenomenal reduction in frother consumption occurred with the use of only 0.005 lb. per ton of AEROFROTH 65 Frother. Furthermore, gold recovery in copper concentrate (desirable at this operation) was increased by over 5%."

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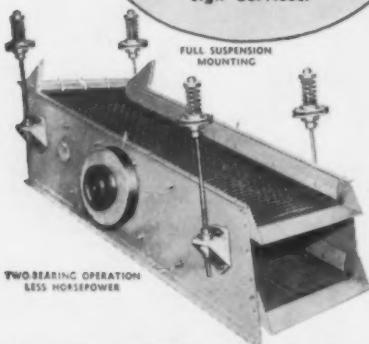
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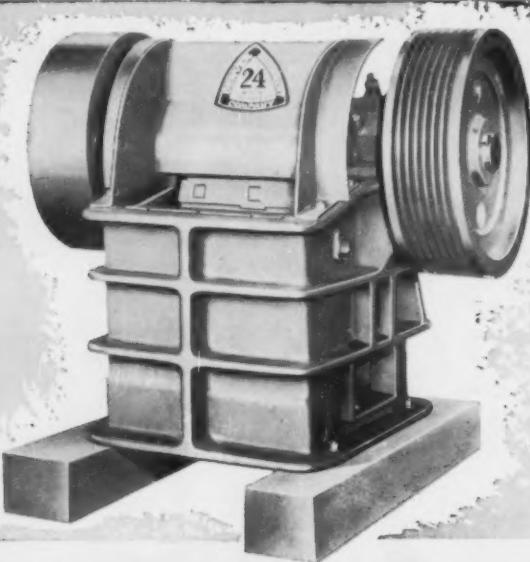
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- Lower Power Cost with two-bearing operation and suspended assembly.
- Positive rapid vibration through "floating circle" action.
- Low operating cost.
- Rugged, simple construction.
- Sizes to 6' x 14', single or multiple decks.

For complete information, WRITE FOR BULLETIN NO. S3-B13.



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Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

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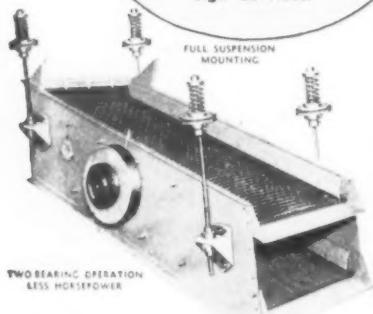
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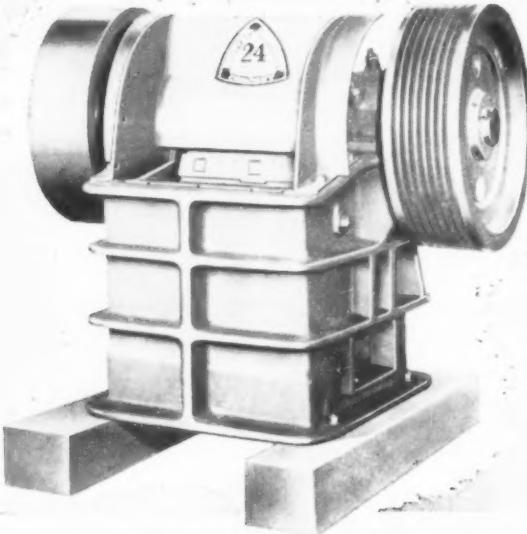
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NEW URANIUM MILL built at Edgemont, South Dakota for Mines Development, features automatic control of leaching and a signal panel registering solution flow in the RIP circuit.



HOSING-OFF RESIN BEADS in baskets of a RIP bank is O. M. McGuire, one of the lead operators. The plant was the first U. S. mill outside of the Colorado Plateau area.

U₃O₈ Processing Made More Efficient By Plant-Controls at Edgemont Mill

By STANLEY DAYTON
Associate Editor

A group of virtual "unknowns", armed with an AEC processing contract and a lot of determination, recently put the nation's eleventh uranium mill in operation at Edgemont, South Dakota. They are now busily compiling an outstanding record. The young organization is Mines Development, Inc. and the treatment facility it built is the first constructed outside the Colorado Plateau in the United States. When the plant went on stream in July 1956, it was the climax of a long, hard, and, at times, uncertain journey to success for Mines Development; but more about that later.

Using the resin-in-pulp process, the new \$2,000,000 mill was designed and built by Western-Knapp Engineering Company working in close co-operation with Mines Development's consulting metallurgist, H. L. Hazen.

Here are a few metallurgical facts that show why Mines Development can justifiably be proud of its achievements. The plant is making a 94 to 95 percent recovery of uranium, and this is figured conservatively. The grade of concentrate is well above the minimum specified by the Atomic Energy Commission. Engineering controls and design have enabled an exceptionally high tonnage per manshift to be obtained. Where the over-all average for all uranium mills in the United States is approximately 3 to 4 tons per manshift, Mines Development processes

over 6 tons per man-shift, including all laboratory and administrative personnel. While the Edgemont mill is a medium-size facility, this ratio is believed to be the highest in the industry. In addition, the plant was operating at a rate well above designed capacity less than one month after completion of construction; a green crew with no previous mill experience had to be trained during this period.

Outstanding features of the mill are many. For instance, pH of the acid leach is automatically controlled by recorder-controllers at any desired acidity. Control of solution flow in the RIP (resin-in-pulp) circuit is certainly a high point of the plant. Designed by Western-Knapp, a unique distribution system completely eliminated the need for expensive valves on pipe lines in the RIP section. Alternating the banks between adsorption and elution cycles is simple, and the distributor circuit makes possible one-man operation of the RIP banks. In addition the flow of solutions and products in the RIP circuit registers on a signal panel containing several lights of different colors. Operators can tell at a glance just how the circuit is set up by observing which bulbs are lit on the signal panel; this provides a visual flowsheet at all times.

In one other aspect Mines Development is unique. Most companies have or control ore deposits of their own; at the present time Mines Development doesn't mine any uranium ore, and operates solely as a custom milling

facility. This contrast sharply with the trend to large mills with controlled ore supply. Ore is arriving at a far faster pace than it can be processed and already plans for a 50 percent mill expansion are in the making.

About 40 different shippers are delivering ore to the Edgemont plant, with the bulk of them located in the Black Hills area of South Dakota, and the northeastern section of Wyoming. Considerable ore is received from the Pumpkin Buttes and Douglas districts of Wyoming. Edgemont ore arrives by truck while northeastern Wyoming and other ore is shipped in via the Chicago, Burlington and Quincy Railroad to a siding adjacent to the mill.

The sampling plant is extremely well arranged, requiring only two men to operate the facility.

Grinding

The two mill bins each have two bottom-discharge hoppers. Regulation of feed rates from the four chutes on the mill bins provides another source of blending control. Such factors as the grade of the ore, the particle size of the sand grains, the slime content, the oxidizing or reducing character of the ore and its lime content are all primary blending considerations. Scheduling of various shippers' lots through the mill is still another method of blending control.

Though the sandstone ores received at the mill are quite abrasive, the ore is easily ground to minus-12-mesh. The grinding installation, consisting of a Denver Equipment Company 4-

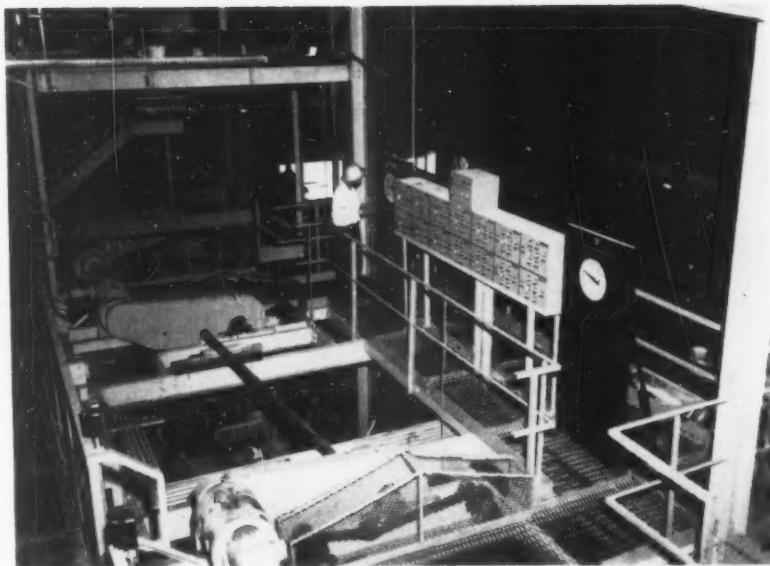
by 8-foot rod mill in closed circuit with a Western Machinery Company 42-inch spiral classifier, should prove adequate to handle contemplated production expansion. Feed to the grinding section is quite fine. The sandstone ores are poorly cemented and crushing, together with repeated handling between the storage area and mill bins, breaks-down a large percentage of the ore to individual sandstone grains. The rod mill carries a very light load of rods (normally about $\frac{1}{3}$ full) to minimize overgrinding.

Leaching

The bulk of the various ores received at the mill are very amenable to acid treatment, and, in fact, should be classed as easily leached. Besides being loosely cemented, the sandstones contain little clay, bentonite, or other substances creating excessive sliming. Little primary ore is received at the Edgemont mill; hydrocarbons and other reducing elements are noticeably absent. Most of the uranium occurs naturally in the oxidized state. For these reasons the use of an oxidant is seldom necessary during leaching in order to put uranium in its more soluble hexavalent state.

Leaching is carried out in a series of four, wooden stave tanks measuring 14 feet in diameter by 14 feet high. The tanks, of Douglas fir construction, were made by the George Windeler Company, Ltd. of San Francisco. Each tank is fitted with a 48-inch, Wemco, rubber-covered propeller mounted on a 4½-inch, rubber-covered shaft.

Sulphuric acid is automatically metered to agitators numbers 1 and 2 in amounts sufficient to maintain the pH at the desired acidity. Depending upon the type of ore being processed, the pH in these agitators may range from 0.9 to 1.4. For this purpose two continuously recording Beckman pH



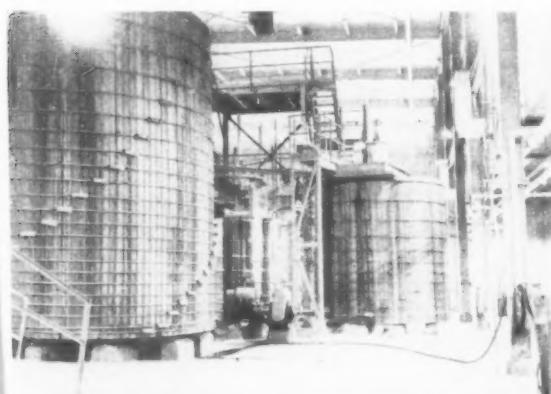
UNIQUE SIGNAL PANEL, designed by Western-Knapp registers exact condition of RIP circuit continuously, showing which banks are on loading or stripping cycles and where solutions are flowing. Recording Beckman pH meters are also used.

meters with Calomel electrodes extending into the agitators are used. The pH meters are coupled to Minneapolis-Honeywell controllers which automatically regulate the flow of acid from the 30,000-gallon acid storage tank. Mines Development has a natural source of hot water and leaching is carried out at a temperature of 40° C. with no attempt to regulate the heat in the system. Fresh water for the mill comes from an artesian well furnishing water at 128° F. and at a well-head pressure of 70 pounds per square inch. Total retention time in each leach agitator is approximately three hours and terminal pH of the pulp overflowing the fourth agitator is usually under 1.5. To keep vanadium in its tetravalent state, thereby preventing poisoning of resin-bead surfaces during ion exchange, powdered iron is normally added at the

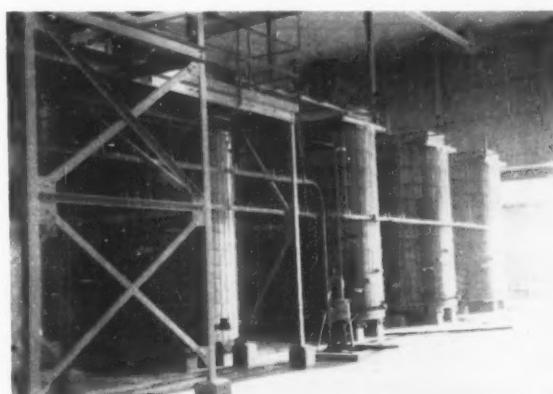
fourth agitator to adjust the EMF of the solution to 400.

With the uranium in solution, the pulp undergoes a sand-slime separation carried out in a series of five, Wemco, 30-inch by 17½-foot-long spiral classifiers and two Equipment Engineers (Krebs) 10-inch cyclones. Three Deco, 2-inch, vertical sand pumps and two Deco 3- by 3-inch SRL pumps handle the load between the five classifiers and two cyclones. Classifier sands advance from number one classifier to number five classifier, receiving a counter current wash, and are discharged from the #5 classifier to the sand-tailings belt conveyor. Fresh wash water is introduced at the fifth classifier at 110 gallons per minute to wash the leached sand and to reduce the pulp density for a sharper

*Text continued on page 40 (WM 28)
Overleaf: Ion Exchange Flowsheet*



LIX FEED holding tank, at left, measures 21-by 21-feet and is made by George Windeler Co. At right is the slime-tailing neutralization tank with lime slurry tank in center.



BATTERY of three Santa Fe tanks at right is used for making up acidified ammonium nitrate eluate. Tank at left is one of the three 12-by 14-foot units for precipitation.

How Ion Exchange Works for U₃O₈

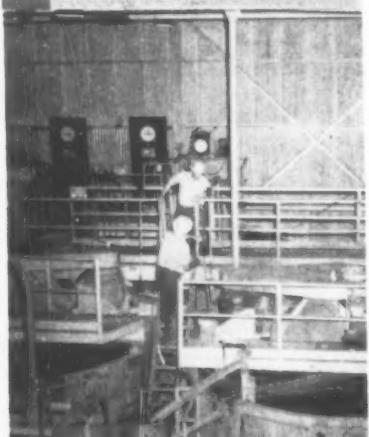
A

GRINDING

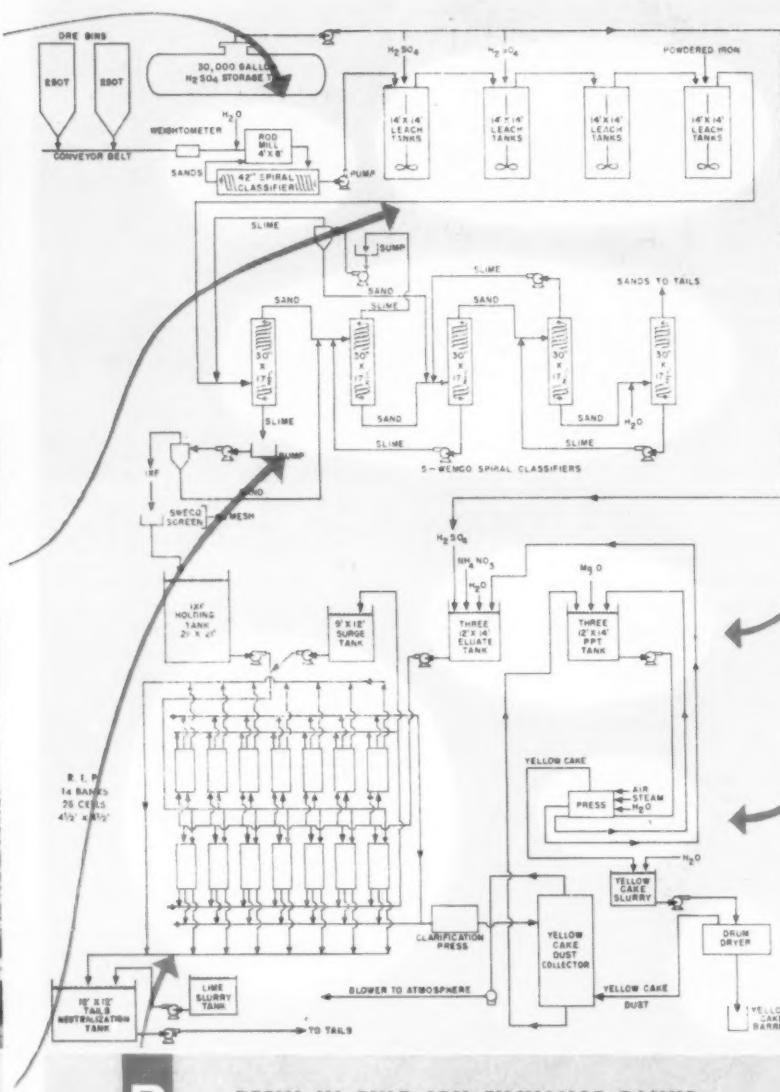
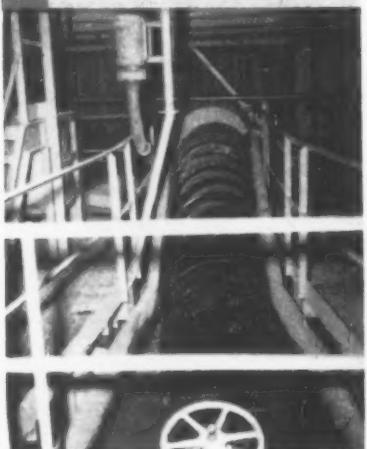


B

LEACHING

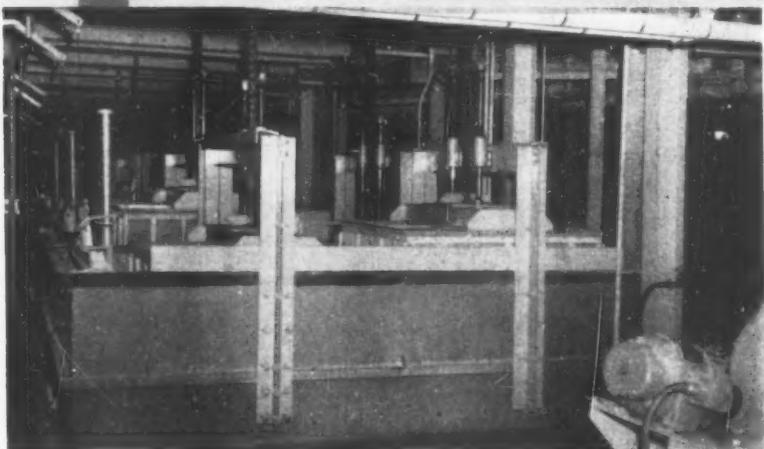


C SAND-SLIME SEPARATION



D

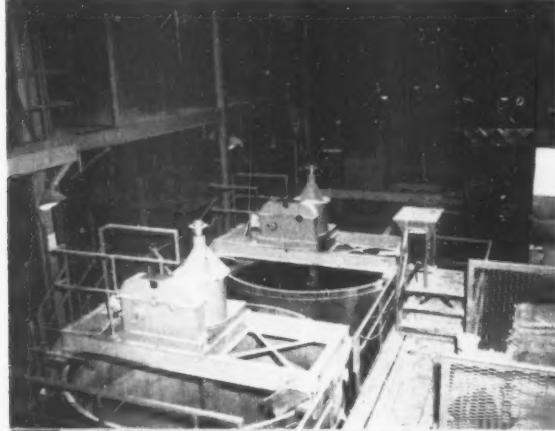
RESIN IN PULP ION EXCHANGE BANKS



At Mines Development's New Mill

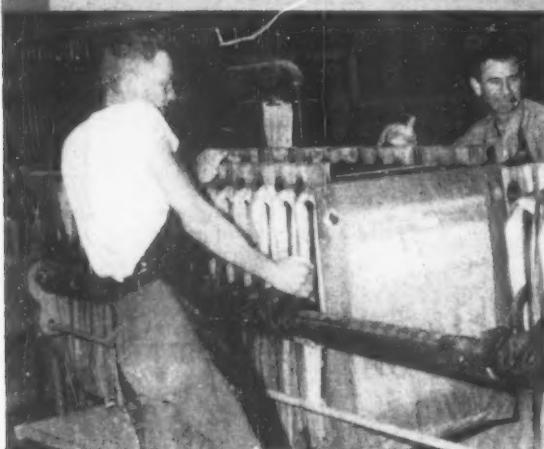
E

PRECIPITATION



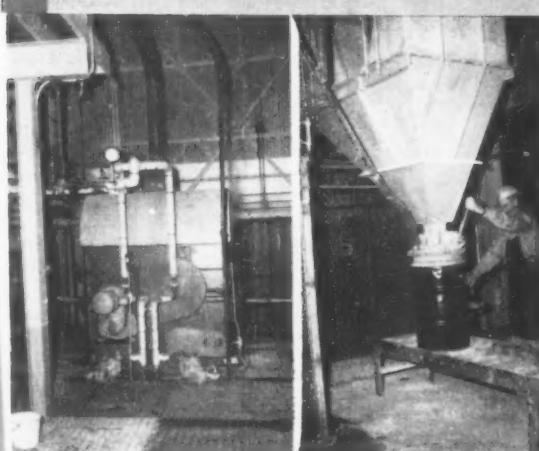
F

FILTRATION



G

DRYING-DRUMMING



Basically, ion-exchange metallurgy for uranium involves the following steps.

1. Ore is leached with acid, and the pregnant solution passed over Permutit SK anion-exchange beads.
2. Uranium is "adsorbed" on the anion exchange beads.
3. Beads are stripped of adsorbed uranium by an acidified nitrate solution.
4. Uranium is precipitated from the nitrate solution.

Two ion exchange processes are in general use. The principle behind each is the same and they differ only in the equipment used and other engineering details. Some mills use ion exchange columns but this equipment is limited to clarified leach pulps. At Mines Development, the RIP process is employed and this has the advantage of being applicable to unclarified leach pulps. With the advent of many new flocculants, the advantage of the RIP process over ion exchange columns is disappearing.

Uranium is taken into solution by sulphuric acid as uranyl sulphate complex. The leach, of course, is not completely selective and subsequent treatment is therefore necessary prior to precipitation in order to obtain a clean concentrate. Uranyl sulphate has a marked affinity for certain anion-exchange resins. The uranium-bearing solution is contacted with resin beads which selectively adsorb uranium from solution. This step is carried out in a bank which is a rubber-lined tank containing cubical baskets made of stainless steel screens. The baskets contain a 10-inch bed of beads and are alternatively raised and lowered in the bank which is filled with the uranium-bearing solution. The action alternately expands and contracts the bead bed resulting in thorough contact between bead and solution. Uranium is loaded on the surface of the anion-exchange resin beads. Following the loading cycle, the bank is drained and ready for elution.

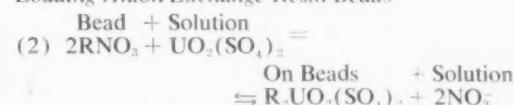
During elution, the uranium is stripped from the bead surface and taken back into solution. An acidified solution of ammonium nitrate is made up for stripping and is introduced to a bank following the loading cycle. Uranium then is subsequently precipitated from the eluant (uranium-rich eluting solution).

The various reactions involved in leaching uranium from ore and then recovering the uranium from solution are quite complex and numerous. These reactions are suggested by the following equations:

Leaching



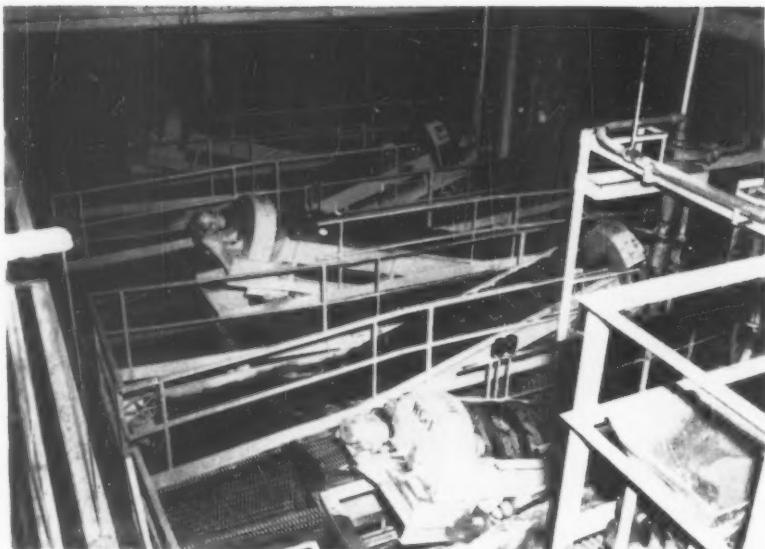
Loading Anion Exchange Resin Beads



Elution or Stripping of Loaded Resin beads just the reverse of equation (2)

Precipitation





SAND-SLIME SECTION consists of five Wemco 30-inch by 17½-foot long spiral classifiers and two 10-inch Krebs cyclones. Sands are washed counter-currently and advance to tailing. Number 1 cyclone overflow is minus-300 mesh.

separation in the cyclones. The Wemco classifiers are set on a relatively steep slope giving a smaller pool surface and longer drainage deck to cut down on possible solution loss of uranium in sand tailing. The overflow from the number one cyclone contains 5 to 10 percent solids (pulp density 1.05) which are minus-300-mesh in size.

This overflow forms the ion exchange feed but it is first screened on a Sweco 4-foot-diameter (Southwestern Engineering Company) vibrating screen with a 100-mesh stainless steel deck. The screen removes wood chips and other trash which might blind baskets in the ion exchange circuit. A 21- by 21-foot Windeler tank provides storage capacity ahead of ion exchange.

R.I.P. Section

The IX feed has these characteristics. The entrained solids are minus-300-mesh; pH is 1.7 to 1.9; concentration of U_3O_8 in the solution is 1.0 gram per liter; EMF of the solution has been adjusted to 400; and pulp density is 1.05.

Ion exchange feed to the resin-in-pulp section is pumped by a 1½-inch Dor-Oliver Alloy 20 pump to a small, steady-head tank at the top of the mill. From the steady-head tank, the dilute pulp is metered by a weir box through a distribution system, described in some detail elsewhere in this report, to the RIP banks.

The RIP section consists of 14, rubber-lined, steel tanks which are known as banks. Each bank contains two stainless steel baskets. The nearly

cubical baskets measure 4½- by 4½-feet in bottom cross sectional area by 5 feet high, and are made of Carpenter 20 stainless steel wire which is fabricated into TonCap 30-mesh openings. The baskets contain a 10-inch depth of Permutit SK 20-mesh beads on the bottom deck. The baskets oscillate up and down in the bank which is filled with solution. The action alternately

Metallurgical Data Mines Development, Inc. Uranium Mill at Edgemont South Dakota

Tons per manshift—6.0
Percent solids of feed to leaching—55 to 60
Retention time in leach circuit—12 to 14 hours
pH of leached pulp (IX feed)—1.7 to 1.9
Density of IX feed—1.05
Size of slime in IX feed—minus 300 mesh
Concentration U_3O_8 in IX feed—1.0 grams per liter
EMF of IX feed—400
Time for adsorption and/or elution cycle—3 hours
Concentration NH_4NO_3 in eluting solution—72 grams per liter
pH of eluting solution—1.2
Concentration of U_3O_8 in eluate—10 to 12 grams per liter
Consumption MgO—0.70 pounds per pound U_3O_8 recovered
Consumption powdered iron—0.5 to 1 pound ton of mill feed
Consumption of sulphuric acid—75 pounds per ton of ore processed
Recovery of U_3O_8 in mill feed—94 to 95 percent
Grade of U_3O_8 in concentrate—+75 percent
Grade of sand tailings—0.006 percent U_3O_8
Grade of slime tailings—0.018 percent U_3O_8
RIP recovery—99.7 percent
Resin loading factor—4.0 pounds per cubic-foot

expands and contracts the bed of resin beads in the basket insuring thorough contact of bead surfaces with solutions. The baskets are raised and lowered at the rate of 6.3 cycles per minute, and are equipped with crossheads which travel in guides bolted to the RIP bank. One motor, which is linked with a lever arm attached to chains, drives the two baskets in each bank.

The banks are alternated between an adsorption cycle, when bead surfaces are loaded with uranium from the IX feed, and an elution cycle where a stripping solution removes the uranium from the bead surface. The practice at Mines Development is to use seven of the banks on adsorption and five banks on elution. One bank between the adsorption and elution cycle is being washed and the fourteenth bank is on standby. Solution from the seventh bank on the adsorption cycle is sent to a 12- by 12-foot tank for slime tailing neutralization.

Considerable concentration and purification of uranium is obtained in the RIP circuit. The anion resin beads in the RIP baskets extract 99.7% of the uranium but only a fractional percentage of the iron, vanadium, and aluminum that are in solution in the IX feed slime. When the resin beads are eluted, the pregnant eluate sent to precipitation assays from 10 to 12 times the uranium assay of the solution in the IX feed.

Control of Bank Cycle

The normal cycle for both loading the resins (adsorption) and for stripping uranium from the loaded resins (elution) consumes about three hours. The counter current principle is employed during loading and stripping. Uranium bearing feed to the ion exchange section enters a bank containing resins most completely loaded with uranium and leaves the ion exchange section from the bank containing the least loaded resins. Also uranium-barren, fresh eluant is introduced to the system at a bank where the beads contain the least amount of adsorbed uranium. Pregnant eluant is taken from the bank containing beads which are highly loaded with uranium. In other words the bank which is taken off the loading or adsorption cycle is the next bank placed in the circuit at the end of the stripping or elution cycle.

Control of the cycles is obtained by taking solution samples at the first and second bank from the discharge end of each set of banks on both the adsorption and elution cycles. Quick fluorimetric uranium determinations are run on the solution samples and the results provide a good guide for

Text continued on page 42 (WM30)

Valveless RIP Section Features Monitored Solution Flow

Mines Development asked the mill designers for an R.I.P. Section that would meet the following specifications:

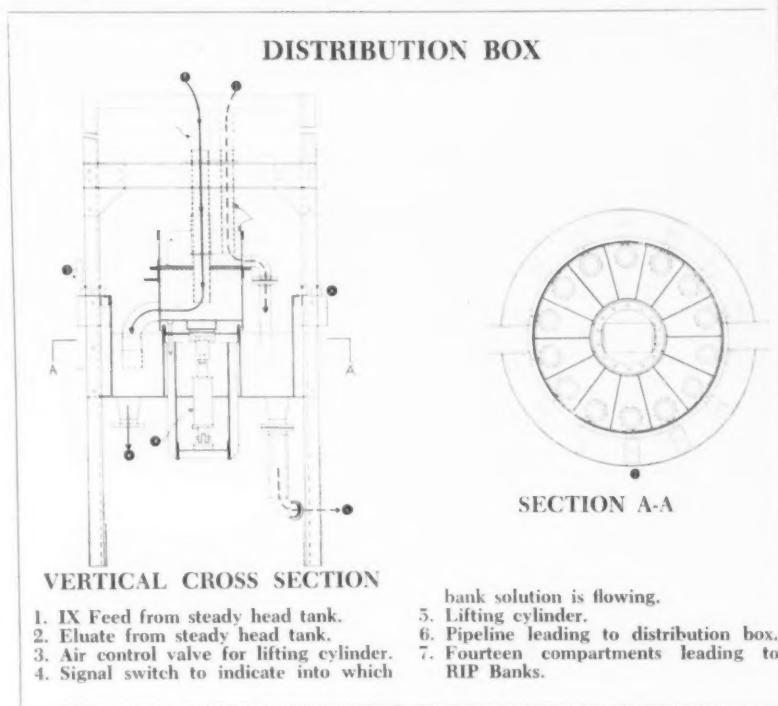
1. No valves in the system; as compared to the 56 valves in most R.I.P. plants.
2. Lights on a conspicuous panel board to report:
 - a. Is each bank operating?
 - b. What is flowing to each bank?
 - c. Where is the pulp or solution going when it leaves each bank?
3. pH indicator and recording meter on the IX feed and the eluting solution.
4. Meters to indicate and control the flows of both the IX feed and the eluting solution.

Designed by Roy Marcellus of Western-Knapp Engineering Company, the distribution system completely eliminated the need for expensive valving on the pipelines in the RIP section. The central unit is a distributor wheel through which IX feed and eluant (stripping solution) enter the banks. A series of 14 distribution boxes are used to regulate the flow of solutions among the banks and out of the RIP section to tailings or precipitation. The product draining from each bank flows to Denver vertical pumps on the floor below the banks. The pumps in turn force solution back up through a swiveled pipe to a distribution box above the bank. There is a pump and a distribution box for each bank in the RIP section.

The distribution wheel mounted above the banks is essentially a horizontal drum divided radially into 14 compartments, and each compartment is separated by a knife-edge partition. Each compartment is connected with a pipeline leading to one bank. Mounted concentrically with the drum and extending above it is a rotary feed mechanism containing two surge boxes which are sealed against leakage of solution between the dividing barrier. Two pipelines lead into the feeder with one line carrying IX feed to one surge box and the other carrying eluant to the second surge box. Diametrically opposite discharge lines drain each surge box through a short pipe containing an elbow. The discharge pipes extend a short distance down into the compartments in the drum.

The rotary feeder is mounted on an air cylinder which raises the unit so that the discharge lines from the surge boxes will clear the dividing partitions of the drum. By throwing the air valve the operator raises the feeder and then manually rotates it clockwise so that the discharge pipes drain to the next compartment in the drum. Thus IX feed and eluant are introduced to the next bank which follows in the cycle.

The distribution box is also divided by knife-edge partitions into four compartments all contained in a single row. At the top of the pipeline on the discharge end of each Denver pump there is a short horizontal length of stainless steel pipe which discharges to the distribution box. This horizontal section of pipe is mounted on a swivel so that the pipe can be swung in a horizontal arc across all the compartments in the box. One compartment of the distribution box sends feed to the pregnant eluate holding tank (holding tank prior to clarifying



cation and precipitation). The second compartment feeds a pipeline entering the next bank in line. The third compartment sends pulp to the slime-tailing neutralization tank. The fourth compartment sends feed back to the surge tank where it again enters the IX feed. The latter compartment handles all wash water which drains from a bank after beads are hosed off with spray water.

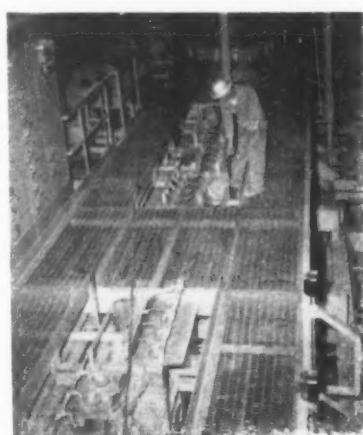
A mill operator manually swings the swiveled pipe feeding the distribution box when it is time to change the flow to or from any of the banks. The swiveled pipe rests in a cradle at each compartment of the distribution box,

and, at every compartment setting, comes in contact with an electrical switch. The switch is a simple contactor type which is normally open until a small plate welded to the feed pipe closes the circuit when the pipe is positioned at a compartment. The closed switches light various bulbs on a central signal panel; several different colors are used for the signal lights, according to a color code, and they are further identified by means of a short label showing solution destination.

Electrical contactor switches are also placed around the periphery of the compartmented drum of the distribution wheel. The switches are similarly closed by means of bearer plates on the pipelines leading from the surge boxes of the wheel and energize a light on a signal panel.

The signal panel consists of fourteen separate subdivisions, one for each bank, each of which contains eight lights. Also included are two Beckman pH meters which record the pH of eluant and IX feed. The lights for each bank signal panel are labeled as follows: eluate, slurry, pregnant, bank, tailing, surge tank, pregnant-sump, and slurry-sump. A glance at the panel shows the exact condition of the circuit set-up at any time.

Changing the solution flow, which occurs every half hour or so, is a matter of swinging the pipelines in the distribution wheel which takes care of IX feed and eluant; and changing the pipeline setting at the distribution boxes of the final banks on the loading cycle and the final bank on the elution cycle. These moves are registered and indicated on the signal panel, simplifying supervision of the RIP section.



HEART of distribution system is wheel at top and boxes in foreground; operator is changing pipe leading into a box.

adjusting the cycle. For instance, when the concentration of uranium in the IX effluent two banks from the tailing end builds-up to a certain point, it is known that trace amounts are entering the tailing. It is then time to take the lead bank off the IX feed and add another bank to the end of adsorption circuit.

When solution has been drained from a bank, the beads must be hosed-off at intervals to keep them wet and promote drainage. The resin beads have a tendency to swell and stick together in a semi-plastic lump if allowed to dry. If kept wet, however, they will readily separate into individual particles. A minimum volume of wash water is used to avoid undue dilution, and for this reason banks are not filled with wash water but merely hosed off. A bank taken off the adsorption cycle must be washed to remove slime adhering to bead surfaces, which would contaminate the eluting solution. Following elution, the beads must be washed to remove excess nitrate. All wash water is recycled to a surge tank which discharges to the IX feed system.

Control of Solution Level

The banks are drained by raising a hollow vertical plunger which fits into discharge ports at the bottom of the bank. Means are provided to control the level of the solution in the individual banks at any desired point. Control of solution level also provides a smooth continuous flow from bank to bank without the danger of surging and overloading any banks in the circuit. Precise adjustment of the liquid level in a bank is maintained by a large funnel which can be set at any desired level in the bank. The funnel is connected with the hollow plunger mentioned above by a flexible rubber hose and drainage is obtained through the hose and plunger to the bank pump.

The eluting solution is made up in three Sante Fe wood tanks. At any one time, one of these tanks is delivering fresh eluant to the RIP banks; the second tank is being filled with barren filtrate from yellow cake filtration; while the third tank, consisting of barren filtrate, is actually being adjusted with acid and NH_4NO_3 . The fresh eluant entering the RIP section contains 72 grams per liter of ammonium nitrate (56 grams per liter of nitrate ion). The eluant is made up as a one mole solution and acidified to a pH of 1.2 with sulphuric acid.

Uranium rich eluting solution leaving the fifth bank on the stripping cycle contains 10 to 12 grams per liter of uranium oxide (expressed as U_3O_8) and this solution is pumped to a preg-

nant eluate holding tank.

Double Filtration

A filtration step is next employed to clarify the pregnant eluate before precipitation of the uranium from the solution. This is done in order to obtain a cleaner uranium concentrate uncontaminated by any slime solids deposited on the beads by IX feed and picked up by the eluting solution. Mines Development is testing the addition of milk of lime prior to clarification of the pregnant solution. Enough lime is added to bring the pH of the eluate up to 3.5 with subsequent precipitation of CaSO_4 (gypsum). This is similar to the method now employed at The Anaconda Company's Bluewater mill (see MINING WORLD, October 1956, page 46) which was the first to use a two-stage filtration—first removing gypsum, then recovering the uranium precipitate. The method permits a cleaner concen-

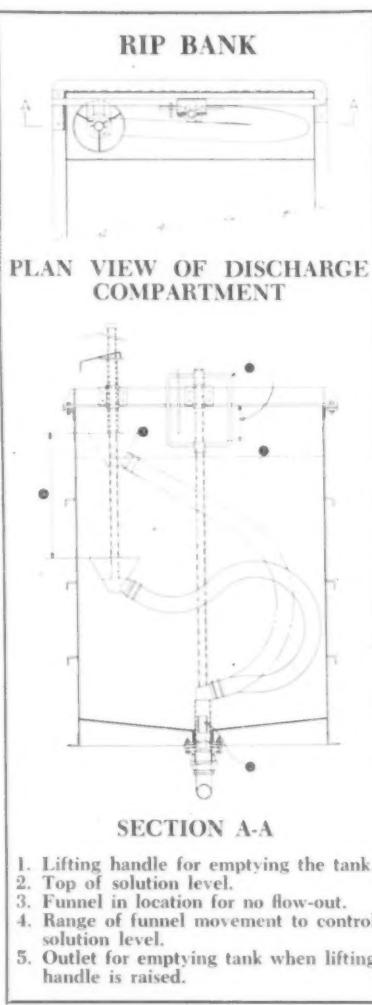
trate to be obtained and helps control sulphate concentration in the circuit. Another method employed to control sulphate build-up is to bleed off approximately 10 percent of the barren filtrate from the yellow cake presses.

The installation used to clarify pregnant eluate before uranium precipitation is a Sperry plate and frame filter press containing 38 frames. Filtrate from the clarification press (eluate) goes to one of the two Santa Fe 12-by 14-foot precipitation tanks after it is first cycled through a yellow cake dust collector where it is used to strip dust-laden exhaust from the yellow cake dryer. One precipitation tank is always being filled while the second is undergoing precipitation. These tanks are fitted with wooden sweeps, made by J. D. Christian Company, which rotate at the bottom of the tank to provide mild agitation and circulation of the liquid during precipitation. The precipitation agent used is magnesium oxide which is added in dry form to produce a diuranate precipitate. The magnesium oxide is a slow acting precipitant, but it has the advantage of producing a relatively large floc as compared to other reagents. Enough MgO is added at the precipitation tanks to produce a solution pH of 6.8. The minimum time required for precipitation varies from a minimum of four hours to a maximum of 10 hours.

A 1½-inch Worthington CNG 84 pump transfers the precipitated slurry to one of the two 30-inch by 38 frame Sperry filter presses on yellow cake filtration. After filtration, the cake is given a water wash and an air blow. On both the clarification press and the two yellow cake presses, a layer of filter paper and a layer of nylon filter fabric are used on the frames.

At the floor level below the filter presses, movable drip pans have been installed above a paddle re-pulper extending the full length of the filter. The drip pan is first rolled out of the way, then the filter is opened. The uranium precipitate scraped from the frames drops to the re-pulper which keeps the cake fluidized while it is delivered to an agitator. The concentrate is pumped to a Blaw Knox (Bullock) double-drum dryer. At the dryer the yellow cake is splashed on rotating drums which are heated on the interior by steam. A thin layer of concentrate forms on the drum and is scraped off dropping to the yellow cake hopper. The uranium concentrate is then drummed for shipment.

The dryer is under a slight vacuum and the exhaust is pulled through a dust separator fitted with a number of ceramic baffles. The liquid scrubbing media, which is clarified eluate, is re-



DIAGRAMS of discharge end of RIP bank shows how positive control of solution level can be maintained at all times.

roduced at the top of the baffles and percolates downward stripping uranium concentrate from the dryer exhaust. The scrubbed gas is then vented to the atmosphere.

Acid Resistant Pipes

Uscelite piping, a hard rubber made by U. S. Rubber Company, is used extensively throughout the mill. The great bulk of this pipe is joined by means of threaded Uscelite fittings. Flanged fittings which are threaded to pipe at one end and bolted at the other to mate the joining flange are used in some instances; threaded, sleeve-type pipe couplings are used in other instances. Joints are generally a point of weakness and also are subject to more wear than other portions of a straight pipe. For this reason a solvent cement is generally applied to the threads of the pipe and coupling to insure a good seal and prevent leaks.

The Uscelite pipe, being weaker than standard metal pipe, is rigidly supported against vibration and sag due to the weight of pipe and the load it carries. At Mines Development a horizontal pipe is supported along its full length by means of an angle iron cradle suspended from structural members of the building or decks by hangers.

Jerry Bryant, Mill Foreman, points out that the proper installation of Uscelite pipe requires considerable care and experience, but that if properly fitted and supported, the pipe is satisfactory in many applications where corrosion is a primary consideration.

There are about 40 pumps in the mill and most are rubber lined although some pumps make use of stainless steel parts such as Alloy 20. Connections to some pumps are made by means of steel reinforced rubber hose which is clamped to a fitting with a steel band.

Classifier flights, cyclones, and RIP banks are also lined with rubber. The use of rubber is so extensive that the company is taking pains to test rubber coating processes so that simple repairs to worn linings can be done at the mill. In one instance, a pump with a stainless steel impeller, which was giving trouble, was given a rubber coating by the maintenance crew. The casing was similarly lined. The enlarged impeller wouldn't quite fit the casing but a thick gasket between the two casing sections solved this problem and the pump is now operating satisfactorily although no check has been made of the pump's performance according to the manufacturer's rating.

Acid resistant paint was used throughout the plant. The floor, which

is particularly subject to corrosive action from spills, etc., was given a primer and two protective coatings of Amercoat paint made by the Amercoat Corporation.

Two stainless steel screens are placed in the mill circuit, to catch

resin beads, which through wear and attrition, slip past the screened stainless steel baskets. Beads are expensive, costing \$55 to \$60 per cubic foot. Theoretical loading factor of beads is usually figured at 3.5 to 4.0 pounds of U_3O_8 per cubic foot.

MDI: A Modern Horatio Alger Story



A. D. GRAY
General Manager



G. T. BATOR
Production Manager



A. W. RUNGE
District Representative



H. D. WEBB
Mill Superintendent



G. H. BRYANT
MILL Foreman

The story of the struggle for recognition of Mines Development, Inc., together with the subsequent award of a milling contract by the Atomic Energy Commission, is as interesting as the new plant. As one company spokesman phrased it, "we had no record of accomplishment and were probably regarded as comparative 'rookies' by the mineral industry."

The ore supply situation in the Black Hills District is such that a custom mill is required. Ore is produced by over 35 independent companies, and the average producer mines and ships less than 300 tons per month. This feature compounded the process of negotiation with the AEC, as it is generally accepted that to successfully obtain a milling contract, the company involved should control sufficient uranium ore to supply from 25 to 50 percent of the mill feed requirements.

Thus, Mines Development needed firm commitments from ore producers covering delivery of ore to its proposed mill. It not only had to sell the operators on the idea that it was the logical company to build a mill, but it also had to show the AEC firm agreements with ore producers, a superlative plant design and a fair price. With negotiations with the AEC well underway, Art Runge, now District Representative with Mines Development, made a winter trip through the mining district securing contractual commitments from various uranium operators. With these in hand, the company was then able to proceed with the final stages of negotiation with the AEC on secure ground.

Credit for the success of the venture must go to the two men who organized Mines Development. Allen D. Gray, the youthful General Manager, was one of the first to recognize the possibilities offered for uranium milling in the Black Hills region. He has devoted his remarkable talents and driving energy toward organization of the company, and he was instrumental in arranging the financing for the project. George T. Bator resigned his duties as a professor at the Colorado School of Mines, and now as Production Manager, directs his broad background of knowledge and experience solely toward the success of the Edgemont mill. These two men, as a team, are setting a conspicuous record in the uranium milling industry.

Consulting metallurgist with Mines Development, Inc. is H. L. Hazen, a former top-notch cyanide man in Nevada who also had considerable uranium experience as consultant with the AEC. Mr. Hazen was a key man in the metallurgical design, and to him goes a large share of the credit for operating success of the plant. To Harold D. Webb, Mill Superintendent, should go a large share of the credit for the coordination of the many complex factors necessary to achieve smooth operations. To do this, Mr. Webb draws on his long experience in metallurgical processes both in this country and in Turkey.

With the AEC contract in hand, many more hectic days were to follow in the period of mill construction. But the "rookies" have come through with flying colors, and are now establishing an enviable operating record. With ore arriving at the plant at a faster pace than was ever anticipated for the district, the company is considering a substantial expansion of its capacity. Things are now humming on a business-like basis, profits are coming in, and it couldn't happen to a nicer group of people.



NEW COPPER MINE in North Carolina is that of Appalachian Sulphides, Inc. at the historic Ore Knob ore body east of Jefferson.

This aerial picture shows new steel headframe and foundations for 700 ton per day floating mill.

Copper Mining In The Carolinas As Appalachian Reopens Ore Knob Mine

By A. E. ROBERTS

New York District Manager



ORE KNOB is really an old mine as this sign shows. From 1873 to 1883, 200,000 tons of copper ore were mined.

North Carolina's first major copper mine since the late 1800's is currently under development by Appalachian Sulphides, Inc., wholly owned subsidiary of The Nipissing Mines Co., Ltd. of Toronto, Canada. Appalachian Sulphides is developing an extension of the historic Ore Knob ore body, located 11 miles east of Jefferson, in the northwest corner of the state.

Shaft sinking has been completed and mine development work is now underway. Construction of the 700-ton-per-day mill started in June 1956, and is scheduled to be completed in February 1957.

The first workings at the Ore Knob property date back over a century to 1855. At that time the ore body was developed by four shafts varying in depth from 30 to 90 feet. The ore, "black copper" or chalcocite, was reported to have averaged 20 percent copper.

After a short period of initial operation, the mine was not worked regularly again until 1873 when it was taken over by new management. Seven additional shafts were sunk and the four existing shafts were deepened. Two of the shafts exceeded 400 feet in depth and the remainder ranged from 60 to 250 feet deep. A smelter with two reducing furnaces and a refining furnace (using charcoal for fuel) was constructed on the site.

By 1883 the price of copper had declined to 9 cents a pound and the mine was closed. During the 10-year period from 1873 to 1883, it is estimated that over 200,000 tons of ore were mined and 25,000,000 pounds of copper recovered. It is interesting to note that for the year 1880 the total cost to produce a pound of copper, including freight and other miscellaneous charges, was 12.5 cents.

In December of 1942 the U. S. Bureau of Mines started a diamond drilling program to determine the southwest, northeast, and downward extensions of the deposit. Twenty holes, to

taling 4,945 linear feet, were drilled along the strike of the vein, and 75 feet of drifting and cross-cutting were completed for underground drill stations. Several of the holes from an underground station on the southeast side of the vein indicated that the ore body pinched down to narrower stringers and plunged to the southwest.

Nipissing Mines became interested in the Ore Knob property in 1953 and the present manager, Philip Eckman, supervised an exploration program that included an electro-magnetic survey. Diamond drilling, contracted by Sprague & Henwood, Inc. of Scranton, Pennsylvania, was started in December 1953. Thirty-eight holes, totaling 27,752 feet, were drilled primarily on the southwest projection of the ore body indicated by the Bureau's results. Ore intersections were made in 15 holes with deepest ore indication at 1,150 feet.

Copper Averages 3.0 Percent

Based on the results of diamond drilling, the ore body averages 14.4 feet in width, is at least 3,300 feet along the strike, has a rake length of 3,550 feet, and varies from 200 to 550 feet in vertical height. Present ore reserves stand at 1,330,300 tons of 3.0 percent copper and 14 percent sulphur.

The ore deposit can best be described as a steeply dipping (70°) tabular sulphide body striking N. 64° E. and raking to the southwest at 20° . It is thought to be a mineralized fault and consists of brecciated fragments of wall rock surrounded and replaced by sulphides. Ore minerals are chalcopyrite, pyrrhotite, and pyrite, with very minor amounts of sphalerite.

Country rock is a quartz-mica gneiss which makes sharp and well defined contacts with the ore body. It is anticipated that the walls will be relatively sound and will require a minimum of support.

Shaft Sunk to 1,037 Feet

A vertical, three-compartment shaft was collared in May 1955. Cowin and Company, mining contractors of Birmingham, Alabama, was awarded the contract to sink the shaft to a depth of 1,037 feet and to cut six stations. The job was completed in July 1956.

The collar is concreted to a depth of 55 feet and steel sets are hung on 7-foot centers to a depth of 1,008 feet. Bearing sets, consisting of four 12-inch I-beams are hitched and grouted every 140 feet—three sets below each station. Wall plates, end plates, and dividers are 6-inch, wide flange beams bolted together to form the set.



LEFT: Mucking out the shaft round with clamshell. Electrically controlled hoist is on surface. A. A. Dundas, mine superintendent, holds flashlight. RIGHT: Perfect core recovery is shown by Val Sheets, diamond drill operator, on the 840-foot level.



Wall plates are 17 feet 9 inches long and the end plates and dividers are 5 feet 6 inches long. Each compartment is 5 foot 6 inches by 5 foot 3 inches inside the steel. Steel ladders are used in the manway with expanded metal landings placed every two sets or 14 feet. Service pipe is also carried in the manway. To prevent rust all the steel was painted with DuPont acid and fume resistant paint before installation.

Grout Bags Used For Blocking

The steel sets were blocked with burlap bags filled with a dry grout mixture. Steel rods ($\frac{3}{4}$ -inch) were grouted in pin holes drilled in the ribs to support the bags. All rods were present, forming a hook on one end to slip over the flange of the steel beam. After the grout in the bag picked up

moisture and hardened, it formed a solid blocking between the steel and the rib. (See accompanying photographs.)

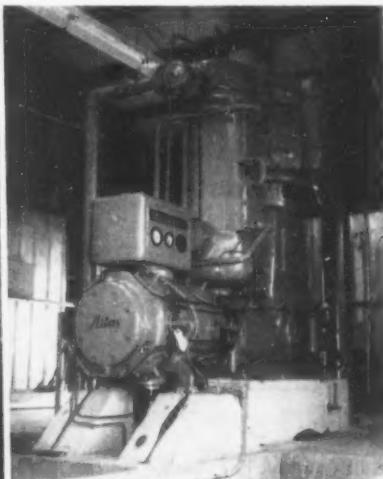
Stations were cut every 20 sets or 140 feet. Six levels are planned starting 280 feet below the collar. As the ground stands fairly well, only roof bolts were required in the shaft and stations.

Shaft Advanced by Benches

The contractor's shaft crew was comprised of a lead man and four shaftmen on each shift. (Two shifts were worked for the major portion of the job.) Twenty-one holes were drilled per bench and each bench round averaged 3.7 feet of total shaft advance. Ingersoll-Rand JR 38A jack-hammers and I-R chisel-type carbide

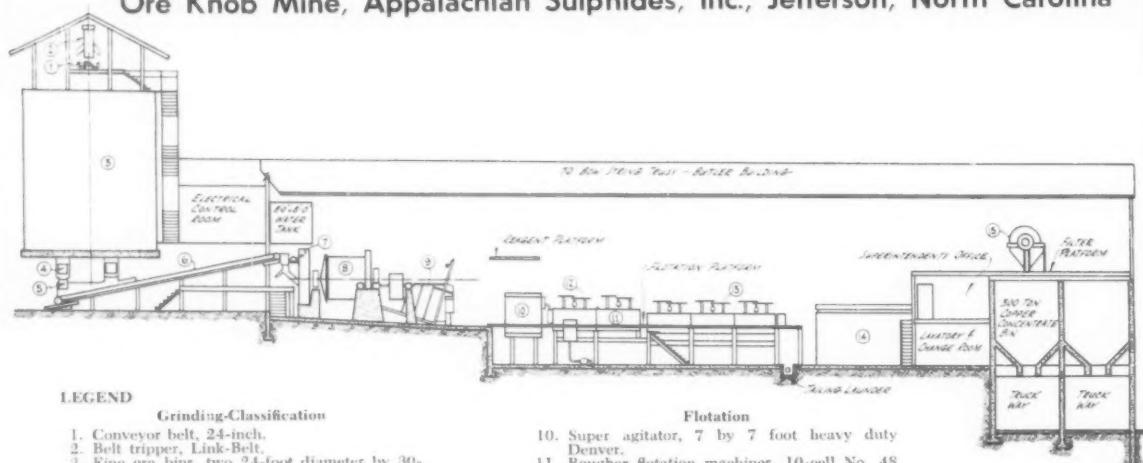


LEFT: Steel shaft sets are blocked with grout bags supported on steel pins set in the shaft walls. The grout sets and hardens for permanent blocking. RIGHT: One of two Atlas Copco AR7 compressors used to supply air for the mine.



Cross Sectional Flow Diagram, Copper Flotation Mill

Ore Knob Mine, Appalachian Sulphides, Inc., Jefferson, North Carolina



LEGEND

Grinding-Classification

1. Conveyor belt, 24-inch.
2. Bell tripper, Link-Belt.
3. Fine ore bins, two 24-foot diameter by 30-foot high Armc.
4. Fine ore vane feeders, five Link-Belt.
5. Belt conveyor, 18-inch.
6. Belt conveyor, 18-inch with Weightometer.
7. Automatic sampler, 21-inch Denver.
8. Ball mill 7 by 7 foot grate discharge type Denver.
9. Spiral classifier, type S 54-inch SSDP Akins.

Flotation

10. Super agitator, 7 by 7 foot heavy duty Denver.
11. Rougher flotation machines, 10-cell No. 48 Agitair.
12. Cleaner flotation machines, 6-cell No. 36 Agitair.
13. Scavenger flotation machines, 10-cell No. 48 Agitair.
14. Thickener, 29-foot 8½-inch diameter by 10-foot high.
15. Filter, 6-foot by 4-disc Agidisc type Eimco.

bits were used for drilling. Holes were finished with an 8-foot steel, loaded with Du Pont 60 percent powder, and fired electrically.

A one-half-cubic-yard clamshell, operated by two I-R K4UL air hoists, was used for mucking. Both hoists were permanently mounted at the collar of the shaft and operated in the center compartment. The clamshell was electrically controlled from the bottom of the shaft by an operator wearing a special control harness. Two guide ropes attached to the clamshell were used for positioning.

By having the air hoists for the clamshell mounted at the surface, all noise and exhaust fog were eliminated during the mucking cycle. Also, no time was expended lowering the air

hoists for the entire sinking operation. Cable stretch, however, and subsequent bouncing of the clamshell tended to decrease mucking efficiency after about 800 feet. Extra cable wear was also a detrimental factor.

A representative sinking cycle taken over a two-week period showed the following distribution of time:

Component	Time in Hours
Drilling & blasting	2.0
Mucking	2.2
Installing steel sets	2.4
Miscellaneous	1.4
Total time	8.0

How Ore Will Be Mined

As the shaft was sunk in the footwall of the ore body, crosscuts will be driven to intersect the ore. Initial work started on the 560, 700, and 840

levels. Drifts will be driven along the footwall of the ore body and waste and ore passes will be raised from the 840 to the 560 level. Grizzlies will be located on each level and will feed through the ore and waste passes to the main loading pocket below the 840 level. Drifts and crosscuts will be 8 by 8 feet in cross section. Atlas Copco BBD-22 Air Leg Drills and Coromant Series 1 integral steel will be used for all drifting and crosscutting.

Present knowledge of ground conditions favors mining by either sub-level stoping or shrinkage stoping. Ore will be mined in blocks with pillars left between blocks. Loading points will be in short crosscuts driven at right angles to the drift and spaced 25 feet apart. Eimco No. 21 muckers will load directly into Enterprise Wheel & Car Corporation 34-cubic-foot side dump cars. Mancha 1½-ton battery-operated trammers will be used for haulage.

Underground pumping is done in two stages. Two I-R 2 GT 75-hp. centrifugal pumps, located at a sump below the 980 level, pump to the 560 level sump. Another identical pump, will pump directly to a tank in the mill after it is completed. Total capacity is 300 gallons per minute.

Sinking Headframe Expanded

The headframe used for sinking was designed by Mayo Tunnel & Mine Equipment of Lancaster, Pennsylvania after sinking was completed, an additional 40 tons



LEFT: Mine manager, Philip Eckinan, supervised the Appalachian Sulphides exploration program at Ore Knob. RIGHT: Mine engineer Sewell Millett. Appalachian is a wholly owned subsidiary of Nipissing Mines Co., Ltd.



of steel was added to the headframe. Overall height was increased from 60 feet to 105 feet and two 7-foot-diameter Lake Shore sheaves were installed. Hoist rope is 1½-inch, 6 by 19 Seale construction Lang Lay manufactured by John A. Roebling's Sons Corporation.

Ore and waste will be hoisted in 3-ton bottom dump skips by a Nordberg 6½-foot by 42-inch double-drum hoist powered by a 250-hp. G.E. "Tri-Clad" induction motor. The skips will dump directly into a partitioned steel bin with a storage capacity of 700 tons of ore, and 150 tons of waste.

Compressed air is furnished at 100 pounds per square inch by a 1,710-cubic-foot-per-minute Atlas Copco AR7 compressor powered by a 300-hp. G.E. synchronous motor. An additional compressor of the same size and make will be installed alongside the first for a future doubling of air capacity.

Results of Flotation Tests

Denver Equipment Company, Denver, Colorado, designed the crushing and milling flowsheet. Construction of the plant is now under way by Appalachian Sulphides and is scheduled to be completed in February 1957.

The Ore Testing Division of Denver Equipment ran a series of metallurgical tests on diamond drill cores. The percentage of copper recovered in the recleaned copper concentrate is expected to be 91.6. Approximately one-half of the copper remaining in the copper cleaner middling (4.4 percent) is expected to be recovered in addi-

tion, making total copper recovery near 94.0 percent.

Mill To Have Twin Circuits

The flowsheet is divided into two twin 350-ton-per-day circuits. One circuit will be completed and brought into operation before work begins on the second. Primary crushing, for both circuits, will be done by a Denver 21-by 36-inch type "J" jaw crusher. Crushed ore will then be divided equally between the two circuits.

Secondary crushing will be done by a 4-foot Symons shorthead cone crusher. Grinding will be in a 7-foot-diameter Denver grate discharge ball mill operating in closed circuit with a 54-inch Akins classifier. Classifier product will advance to a 10 cell Agitair copper rougher. Float will be cleaned and recleaned in Agitair 4 and 2 cell units, respectively. Concentrate will be thickened and then filtered in a 6-foot-diameter by 4-foot Eimco Agidic filter.

Iron Circuit Planned

Current planning includes an iron circuit to recover an iron sulphide concentrate. Finalization of these plans depends on the marketability of the sulphur content. If the circuit is included, the tailing from the copper rougher will go to a 10 cell Agitair unit which will float the iron sulphide. (If the iron circuit is not included, this unit will act as a copper scavenger.) Iron concentrates will then be thickened and filtered.

Concentrates will go to a 300-ton copper bin, and a 400-ton iron bin. From the bins the concentrates will be

trucked 13 miles to Smethport, the closest rail head, near West Jefferson, and shipped to custom smelters.

Pre-Fab Buildings Erected

The mill, hoist and compressor house, warehouses, and other plant buildings, except the main office and staff houses, are Butler pre-fabricated buildings. Siding is galvanized steel and the roofs are aluminum sheeting. Staff houses with two, and three bedrooms were completed in April 1956. At present, there are five staff houses, and three additional ones are planned for the future.

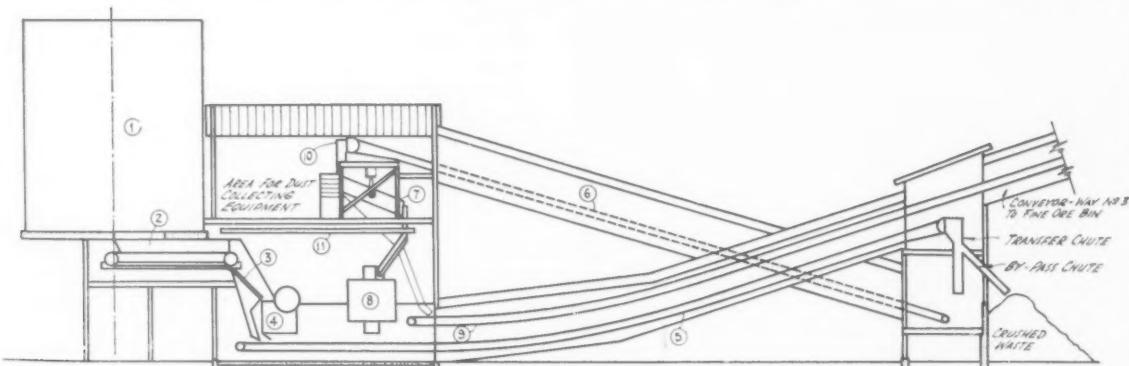
Domestic and plant water supply is pumped from a company built dam through 6,200 feet of 8-inch Johns-Manville transite pipe. A Fairbanks Morse 100-hp. Pomona turbine pump delivers 600 gallons per minute to two 80,000-gallon wood stave storage tanks. An additional 100-hp. Pomona pump is installed in the pump house for standby. A 6-inch service line and a 6-inch fire line service the plant from the tanks.

Staff personnel at the mine include: Philip Eckman, mine manager; A. A. Dundas, mine superintendent; George F. Barkhouse, mill superintendent; Sewell Millett, engineer; Dewey Kirstein, field geologist; E. L. Tomney, accountant; W. A. Stoughton, assayer; C. L. Crouse, master mechanic; Noah J. Meyers, electrical superintendent; and L. V. Sheets, construction foreman.

J. F. Cowley is general manager of Appalachian Sulphides, and J. M. Cunningham-Dunlop is president and director.

Cross Sectional Flow Diagram, Crushing Plant

Ore Knob Mine, Appalachian Sulphides, Inc., Jefferson, North Carolina



LEGEND

1. Ore and waste bin, 28 foot diameter by 33 foot high, Armco extra heavy sections.
2. Apron feeder, 42-inch by 19-foot Type J Denver.
3. Fixed grizzly, 3 by 6 foot, 3-inch slots.
4. Jaw crusher, 21 by 36 inch type J Denver.
5. Belt conveyor, 24-inch.
6. Belt conveyor, 24-inch.
7. Double deck vibrating screen, 5 by 10 foot Denver Dillon, ½-inch cloth.
8. Shorthead cone crusher, 4-foot Symons.
9. Belt conveyor, 24-inch.
10. Suspended magnet, RMA-60 Dings.
11. Chain hoist, 5-ton Yale trolley type.

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The Big Events in 1956

By GEORGE O. ARGALL, JR., Editor



San Manuel . . . Underground Mine of Year



Berkeley . . . Open Pit of Year



Ambrosia Lake . . . Uranium Bonanza of Year

The mining industry has just finished another big and important year. There still are bigger years ahead. Remembering that coming events cast a shadow before them, it is time, once again, to review the outstanding developments of the year just ended and to forecast the future, blessed with this hindsight.

What of the future? As has long been pointed out, the future is a most democratic institution with equality for all to pick, to prophesy, and to profit. No one has the inside track on the future; if you like forecasts, fine and dandy. If not, you are wasting your time reading this article and should pursue your own way of thought and make your own predictions.

"The future is always difficult, largely unknown and unworkable, and the present only appears to be more complex than the present of some time ago. The balance sheet of the present always strikes a level, with the pluses and minuses balancing out and giving no particular clue as to what we do."¹ The mining industry in 1956 chalked up more pluses than minuses for the predictions made in a similar article, "Industry Review: Mining in 1955 and a Forecast of 1956 Trends," just one year ago.

The future must of necessity be tempered by current Middle East developments. What probably will happen is the continuing exchange of diplomatic notes between Russia and the United States with much jockeying for position by the Arab and European nations. The United States is not going to start a war. Russia will not; despite the prestige lost by the contradictory notes and ultimatums from the Kremlin. Russia has too many Satellite troubles, and too much to do at home in improving food production, increasing the standard of living, and maintaining peace among the top Commissars.

But, do not for a moment think that the "sweet Geneva spirit" has not become a bitter affair.

In the long run Suez may be best remembered as an event of propitious importance. It serves once again, most effectively, to point up the problems of long distance shipping of minerals to the United States. The United States is still the best place to find and develop mines. Suez should and probably will refocus the mineral spotlight on Latin America, and this is pointed out by Charles Will Wright in his article in this issue titled "World Events Dictate Great Need For Development of Latin American Mines." Truly the Americas can become self sufficient in all possible mineral needs.

Here were the most significant developments of 1956 on the broad minerals industry fronts.

In metals there was a shifting from scarcity to abundance—in everything from aluminum to zircon. The government stopped stockpile buying of aluminum late in the year and the major producers instituted a campaign to urge more use of aluminum—particularly in the building field. Further aluminum expansion is underway and its remarkable use-growth will continue. Copper, the Metal of 1955, ended 1956 in over abundant supply for immediate markets, but its growth picture is also strong. Both a more stable supply and a growing supply are assured

¹ From a speech before a private group by Armand G. Erph, Partner Carl M. Loeb, Rhoades & Co., New York, in San Francisco, California on December 13, 1954.

Mining—Preview of 1957

which means that emphasis will be on the design of products to take full advantage of copper's unique physical properties. With no labor strike, production reached an all-time high in the United States of about 1,100,000 tons. This is the more remarkable because both Phelps Dodge Corporation and the Anaconda Company cut output up to 7.5 percent in early November. Selenium, the metal to prospect for in 1956, continues to be in very short supply with European prices climbing to well over \$20.00 per pound. A selenium mine is still a good mine to search for. Unfortunately production to date has been a byproduct. Paradoxically, the market for selenium ore is practically non-existent. In New Mexico a uranium discovery of good grade but limited tonnage was found to have a high selenium content. Efforts to find a market for this ore where both uranium and selenium would be paid for were unsuccessful. The U. S. Bureau of Mines said, "Sure, we're interested. Send us a big sample, tell us what your reserves are and we'll keep in touch with you." This is not meant to discourage any selenium prospecting but to merely indicate marketing problems. How different it would have been if a discovery of several hundreds of thousands of tons of, say, 0.85 percent selenium-bearing rock had been found. That would develop into a selenium mine, not a byproduct source.

Cobalt, so much in demand only a few years ago, is now in adequate supply for all uses. The cobalt producers in Africa and the United States know that increasing supplies mean a campaign to promote additional uses.

The Tungsten Institute's fine program to develop new uses for tungsten, and to encourage increased use of tungsten to take advantage of its superior properties for high temperature and high strength alloys has been noteworthy. Results have been encouraging and the use curve is definitely up; in fact, increased use of many of the metals could go a long way toward solving the miner's problems.

Nickel is one of few metals where demand continues far ahead of output. Major new mine expansions have been announced, or are on the drawing board, in Canada and Cuba.

Iron ore demand has been literally short of terrific, caused by both the mid-1956 steel strike and the 100 percent plus output of blast furnaces. This demand should continue well into mid-year. During the strike Canadian producers continued operations and United States steel companies made special efforts to handle and stockpile large tonnages of imported ore.

What about the metal of 1956? Nickel, rutile, uranium, lithium, and zirconium have all been mentioned. However, *Boron was the Metal of 1956.*

Boron, actually amphoteric, was the metal of the year, not because production is steadily climbing and in 1956 was over three times as high as in 1945, but because boron may well be the rocket fuel of the future. While many details remain classified, it is known that boron compounds have high energy fuel requirements. It is already known that pentaborane and decaborane have high energy content and desirable physical properties for rocket fuels. With over \$70,000,000 already available from Defense funds for development of high energy propellants, boron may well be the metal of tomorrow in addition to the metal of the year. An additional \$100,000,000 worth of plants has been contracted for to make high energy fuels in which boron



Rare Metals . . . Mining Company of Year



Republic . . . Flotation Mill of Year



Calera . . . Metallurgical Plant of Year

What To Expect in 1957—And Beyond

You can expect to see a great deal more research and practical experimentation to control or stabilize open pit banks. Minnesota iron miners have already shown the way by experimenting with various methods of electro-osmosis stabilization of soil banks (largely glacial till, much of it with a high water content). In western mines stabilization of rock will permit steeper banks which means less stripping, shorter waste hauls, and cheaper mining. It has been estimated that for a big pit, such as Utah Copper or Morenci, up to \$1,000,000 can be saved in stripping costs for every 1° that the pit slope can be steepened. Steepening of pit banks would save over \$100,000,000 a year in stripping costs.

The giant slide on the western end of Kennecott Copper Corporation's Copper Flat pit at Ruth, Nevada is proof that stabilization is needed. Kennecott also had a very much smaller slide in its Utah copper mine.

There is no question that the silver users association as well as the eastern silver manufacturers will press their vicious attacks on the laws of the United States, justly and rightly enacted by Congress, governing the purchase of newly mined silver.

There will be more special preparation of underground haulage roads. At least one Canadian mine is planning to pave its main haulage incline with concrete to cut tire wear and improve traction. In Missouri, St. Joseph Lead Company tried unsuccessfully to pave its underground haulage roads with several types of asphalt surfacing materials. Interest in dust allaying chemicals, tested by Kennecott at several pits, will continue.

There is a very good chance for the eventual development of at least two more open-pit copper mines in the Ely-Ruth-Kimberley district of Nevada. They will not be large enough to justify rail haulage.

Watch the growing importance of hydrometallurgy as an ore processing method. Uranium has shown the way with both ion exchange and solvent extraction processes. Research has advanced further than is generally known for adaptation of similar techniques for base metal recoveries; in fact, processes and resins have already been perfected for other metals.

Has there been another major copper discovery in the Mineral Hill mining district of Arizona? Surface diamond drilling has recovered copper-bearing cores but no results have been announced. This is not the same deposit as the one where Duval Sulphur Company has developed millions of tons of low-grade copper mineralization, however.

Leach-precipitation-flotation of copper ores will grow in importance. Look for the eventual erection of a major plant in South America to use this process to increase copper recovery from ores currently being floated.

The future will see upgrading of bauxite ore on a large scale. With aluminum production increasing so rapidly, new mines in heretofore non-producing countries are being opened. The older mining areas, particularly in Surinam, are testing HMS as a method of upgrading ore which means greater future mining of lower grade deposits.

A major new copper flotation mill is definitely planned for Nevada. However, its completion will be later than 1957.

Large-scale underground mining of iron ore in Utah should become a reality before too many years. All production to date has come from pits. Also don't be too surprised if a major ore preparation plant will be built there. Gravity concentration and sintering are two possible methods.

Beneficiation of iron ore is in the cards for South America. While there are many large reserves of high-grade ore, other deposits are higher in both silica and sulphur as mining goes deeper—hence a beneficiation mill.

In the United States the trend definitely will accelerate toward iron ore preparation plants. They may be as simple as sizing and drying or as complex as flotation and agglomeration. The steel industry is getting more particular about better and higher grade furnace charges. The iron miners and metallurgists are ready to fill their demands, but the steel men must be ready to pay higher prices for premium furnace raw materials. There definitely will be several additional plants to use Michigan's specular hematite as an iron source. Also in Michigan will be an ore preparation plant for underground ores.

Don't underestimate the possibilities for MOC, magnetic oxide conversion, in the iron industry; that is, fluid bed roasting of oxides to relatively easily concentrated magnetite.

undoubtedly plays a most important part. Don't overlook underwater rockets fueled by boron either, because boron hydrides and derivatives react violently with water.

Technological Achievement of 1956 was the application of solvent extraction to several commercial uranium mills. Technologists who had much to do in developing this process under the United States Atomic Energy Commission's programs were Dr. Richard Bailes, Pittsburgh, California laboratory of the Dow Chemical Company; Mr. Keith Brown, Oak Ridge National Laboratory, Oak Ridge, Tennessee; and Mr. Bruce Clemmer, Salt Lake City, Utah laboratory of the U. S. Bureau of Mines.

For 1956, *The Open Pit Mine of the Year* was Anaconda's Berkeley pit—it was described for the first time in the technical press in the November 1956 issue of MINING WORLD. Berkeley brought a new look to Butte where all product from the "Richest Hill on Earth" had been by underground mining. Berkeley will add much to the output from the Hill as its 100,000,000 tons plus of 0.8 percent ore is mined.

Foreign Open Pit Mine of 1956 was Nchanga Consolidated Copper Mines Limited's open pit at the Nchanga mine in Northern Rhodesia's copperbelt. After stripping over 7,000,000 tons of overburden, first ore was mined late in the year. This is another example of open-pit mining for copper in one of the world's largest underground mining districts.

The United States Underground Mine of 1956 was San Manuel Copper Corporation's mine at San Manuel, Arizona. This block-cave-mine with a scheduled daily production of 30,000 tons is the largest underground mine ever planned and carried to production in the United States without expanding from a smaller operation. On January 23, 1956 the first block was undercut and caved. Close runner up to underground mine of the year was Rio de Oro Uranium Mines, Inc.'s uranium mine in fabulous Ambrosia Lake. Rio de Oro, a small company with aggressive management, stepped in where larger companies feared to tread and was the first to mine Ambrosia ore, proving that underground mining was practical, that the ore-bearing Westwater sandstone is a competent rock, and that water in the northern section of the district was no problem.

The United States Flotation Mill of the Year was Marquette Iron Mining Company's Republic, Michigan mill concentrating specularite hematite (jasperite). It is one of the best designed, well constructed, perfectly maintained, and efficiently operated flotation mills built during the year.

Special tribute is due to the new uranium mills that went into operation during the year: Anaconda Company's Bluewater, New Mexico; Rare Metals Corporation of America's Tuba City, Arizona; Mines Development Inc.'s at Edgemont, South Dakota; and Uranium Reduction Company at Moab, Utah. A visit by these base metal mill operator to these plants is a surprisingly wonderful experience.

The *Foreign Mill of 1956* was East Daggafontein Mines Ltd. in the Union of South Africa which pioneered and proved the many advantages of Aerofall grinding-classification for gold-uranium ores.

Calera Mining Company's Garfield, Utah cobalt refinery without question was the *Extractive Metallurgical Plant of 1956*. During the year the plant reached capacity operations after overcoming many very difficult corrosion and pressure

problems. Among other things, it proved the successful use of titanium metal to overcome these problems.

Eagle Mills pelletizing plant of Marquette Iron Mining Company at Eagle Mills, Michigan which agglomerates Republic flotation concentrate is named the *Concentrate Preparation Plant of 1956*. It is the world's first commercial plant to agglomerate hematite concentrates.

Geological Discovery of 1956 was the extensions of Mt. Isa, Queensland, Australia mineralization by Mining Corporation Australia N. L. In its first diamond

drill hole, spotted by geologic study, 669 feet of copper formation were cut south of the copper ore body of Mount Isa Mines Ltd. Further drilling in a different area, but nearby, disclosed lead-zinc mineralization.

United States Discovery of 1956 was the Red Buttons tungsten ore body 50 miles northwest of Glen, Montana. The ore found by a rancher-prospector can be easily mined by open pitting, is high grade, and very accessible. Minerals Engineering Company acquired the claims, simultaneously started drilling and min-

ing, and when first ore was shipped to company's Glen flotation mill in September over 100,000 tons of 1.18 percent WO₃ ore had been indicated by drilling of only a small part of the ore body.

The many discoveries and extensions of the Ambrosia Lake uranium district were most important too. However, while each is a new discovery and normally might be considered the discovery of the year, this just wasn't so in 1956 because the real Ambrosia discovery was in 1955. The truth is that Ambrosia Lake in 1956 might well be the discovery of the decade.

Ambrosia and Mill Contracts Feature U₃O₈

Just two words "Ambrosia Lake" are all that is needed to describe and typify *United States Uranium in 1956*. Actually Ambrosia Lake, before Louis Lothmann drilled his now famous series of holes north of the dry abandoned Dysart No. 1 oil well in Section 11, T. 14 N., R. 10 W., was a grass covered bottom just to the west of Ambrosia Lake dome with its dry hole. The "Lake" had real water in it for only a few days following a desert storm or cloud-burst and it was a source of water for ranchers' cattle.

Ambrosia Lake is only one segment of the larger Grants-Laguna district which encompasses the fabulous Jackpile open pit, the Climax-St. Anthony ore body, and the Haystack Mountain and Poison Canyon deposits.

By all counts, except production, this area continued to lead the uranium industry during the year: in feet of exploration hole drilled, in number of ore bodies discovered, in point of total ore reserve tonnages, and in number of mills projected.

By contrast, in the Moab-Big Indian district of Utah where so much happened in 1955 no comparable discoveries were made in 1956. Mining reached full maturity, and, in fact, might have been over the peak at year's end. One large mine had pulled pillars for several months; Hecla's Radon mine started a retreating caving plan; and development headings at several other mines probed the outermost fringes of ore bodies late in the year. Production was the trend at Big Indian in 1956, and it was profitable production too as reported by Utex Exploration Company, Homestake Mining Company, Hecla Mining Company, and Standard Uranium Company. Milling at Uranium Reduction Company's Moab mill is future trend. Continental Uranium Inc. will not build its authorized mill at La Sal, Utah.

All this adds up to the fact that there is a very large future for Ambrosia. Just how big it will be eventually no one knows because drilling continues. In 1956 these very important discoveries were made. Kerr McGee developed multi-million ton reserves in Section 22, T. 14 N., R. 10 W. United Western and associates in Section 32, T. 14 N., R. 9 W. and a smaller deposit in Section 36, T. 14 N., R. 10 W. Holly Minerals Corporation, subsequently sold to Phillip Petroleum Company, developed several millions of tons of ore in Sections 21, and 34, T. 14 N., R. 9 W. The latest big discovery was Calumet and Hecla, Inc.'s. in Section 23, T. 13 N., R. 9 W. Major and substantial tonnages were also developed during the year by Rio de Oro-Homestake; Pacific Uranium Company; Sabre-Pinon group; Anderson Development Corporation; and others.

How does it all add up? To the fact that Ambrosia will be a \$1,000,000,000 camp, and perhaps a \$2,000,000,000 camp when all the uranium ore has been mined, milled, and sold. How do you figure? Taking the price of uranium concentrate at the only published figure of \$8.00 per pound and knowing that the mill feed, after dilution and

blending, will average five and a fraction pounds per ton you get \$40.00 per ton ore. Recovery will be well over 90 percent, too. This leaves tonnage as the one unknown. Already the 25,000,000 tons necessary to make it a billion dollar camp have been indicated by drilling by the companies mentioned above.

How significant is all this? Just that Ambrosia is a camp which has ore valued about the same as the total value of all copper, gold, silver, lead, and zinc mined to date in New Mexico. The Black Hills, Leadville, Tonopah, Silverton-Ouray-Telluride, Park City, and other famous base metal camps each have a gross production valued at less than Ambrosia's potential.

The big question, and it is an important one, is what is the market for all this uranium? The mining industry, without question, can mine, process, and refine the uranium. However, the buyer or market must be there before Ambrosia will be truly a billion dollar camp. Undoubtedly there will be a market but it may take several tens of years to convert all the uranium into dollars.

Perhaps 1956 will be remembered as the year of the big uranium milling contracts. By early December when this was written the United States Atomic Energy Commission had awarded seven contracts during the year for the following new mills: Texas-Zinc Minerals, Mexican Hat, Utah, to treat primarily White Canyon's Happy Jack mine ore. (Mill at White Canyon predicted in this section last year). Dawn Mining Company, Newmont Mine Corporation subsidiary at Ford, Washington. (Predicted for Spokane area). Lost Creek Oil and Uranium Company, and Lucky Mc Uranium Company are building mills in central Wyoming. (Only one mill predicted there). Union Carbide Nuclear Company is building a new mill west of Rifle, Colorado to replace its present Rifle mill, and also building new-process chemical upgrading plants at Slick Rock, Colorado, and Green River, Utah. Trace Elements, Inc. received a purchase contract calling for an extension and enlargement of its preliminary mill contract at Maybell, Colorado. Immediately Union Carbide bought out Trace Elements. Atomic Fuel Extraction Company received a contract for a mill at Bedrock, Montrose County, Colorado. Also in Colorado to make it the "millingest," by number, state in the nation was that of Gunnison Mining Company to treat Los Ochos mine ores. Incidentally this is the first Colorado non-sedimentary ore mill and because of the non-sludging, clean ore, solvent extraction will be used.

Significantly no new contracts have been awarded to treat Ambrosia ore despite the huge drilled-out reserves. Contracts are under negotiation by Homestake-New Mexico Uranium Partners (Rio de Oro Mines Company-United Western Minerals Company-White Weld and Company-San Jacinto Petroleum Company); Kerr MC Nuclear Fuels Company; Calumet and Hecla, Inc.; the Sabre-Pinon group; and Phillips Petroleum Company.

Foreign Discovery of 1956 was in British Columbia where deep diamond drilling on a copper prospect staked many years ago and on which drilling was started by American Smelting and Refining Company in 1955. This is the Jersey zone of Bethlehem Copper Corporation at Highland Valley where more than 100,000,000 tons of 0.85 percent copper were drilled out. First vertical hole assayed 0.85 percent for 730 feet. This is a typical example of discovery of an important ore body in an old district.

The *Geophysical Discovery of 1956* was made in Canada by the Hudson Bay Mining and Smelting Company. It was Chisel Lake, discovered by an electromagnetic survey despite the fact that the ore body apex was buried under 10 feet of water and up to 100 feet of silt under Chisel Lake. The anomaly was weak, characteristic for zinc sulphides, and might have been overlooked. A nearby diamond drill drilled the anomaly, however, with the favorable result that an estimated 4,000,000 tons of ore have been indicated. The discovery was made during an extensive prospecting campaign by Hudson Bay in the Snow Lake area 70 miles east of Flin Flon.

The new gradiometer invented by Boyd D. Boitnott of Houston, Texas is considered to be the *Geophysical Instrument of 1956*. The small compact instrument is readily carried in an airplane and has been test flown successfully at 3,500 feet where a 40,000,000-ton ore body at considerable depth was indicated. The new instrument continuously records variations of the gradient of the vertical gravity field component. This eliminates calculations for horizontal component due to elevation, topography, etc.

The African continent again was the scene of major *Underground Records in 1956*. Doorfontein Gold Mining Company, Ltd. reported a record advance of 1,962 feet in 26 consecutive working days from one heading in a 9- by 9-foot cross-cut 5,850 feet underground. The best 24-hour advance was 81 feet. Total muck handled was 15,700 tons, more than the tonnage of ore mined at many mines during equivalent period.

Roan Antelope Copper Mines Ltd. reported an even greater performance by driving 2,006 feet in 25 days during February. About 21,000 tons of muck was broken and removed in this instance.

The *Milling Article of 1956* was "How Rare Metals' New Mill Recovers U₃O₈ From Arizona's Painted Desert" in the September issue of MINING WORLD. Also MINING WORLD had the opportunity of printing the *Mining Article of 1956*. It was a complete description of Anaconda Company's Berkeley pit at Butte. It was in the November issue.

Greatest Disappointment of 1956 was the fact that only one underground uranium mine reached production at New Mexico's Ambrosia Lake, where many millions of tons of good grade uranium ore were developed several hundreds of feet below the surface.

The *United States Mining Company of 1956* was a small company, but it grew rapidly after being selected as the fastest growing mining company in 1955. It is Rare Metals Corporation of America which did so many things so fast after it was formed in May 1954. Technical descriptions of its Idaho-Almaden mercury operations near Neisser, Idaho, and uranium at Tuba City, Arizona have appeared in MINING WORLD.

Another small company which deserves special commendation is Consolidated

Eureka Mining Company Ltd. at Eureka, Nevada which started geologic exploration in an old mine two years ago with limited funds and ended 1956 with assets of over \$250,000. It is now mining about 500 tons of ore a month with a small crew which nets about \$100.00 per ton at the smelter.

The three copper giants—Kennecott Copper Corporation, Anaconda Company, and Phelps Dodge Corporation were all strong runners—not because of the paradoxical situation where all had highest 1956 earnings in history despite a declining copper price, but for the following reasons: Kennecott, because its exploration subsidiary—Bear Creek Mining Company—actually started to do some digging in Utah's Tintic district; Anaconda, because it did so many big things—from aluminum to zinc at so many widely scattered operations; Phelps Dodge, for its sudden switch to exploration and expansion—uranium in Wyoming and copper-zinc in California's Shasta County. Incidentally, last year MINING WORLD reported the latter was a district to watch.

The *Foreign Mining Company of 1956* was Rio Tinto Company of London. This 75-year-old giant with London headquarters formed several subsidiaries and moved in a big way into copper in the Federation of Rhodesia and Nyasaland; into uranium in Australia, and Canada. Its Canadian companies have contracts which will necessitate milling the largest tonnages of uranium ore on the North American continent.

The *Mining Man of 1956 in the United States* was John B. Knaebel, assistant to the vice president for mining of the Anaconda Company. Under his direction, Anaconda has become a major uranium producer and will continue to be for some time. Flying his own airplane, he discovered the outcrop of what is now the Jackpile and North Jackpile mines, north of Laguna, New Mexico, where he supervised the development of the world's largest open-pit uranium mine. One of the world's largest sandstone uranium mills built in record time under his supervision treats this ore. These are all tangible achievements. Even greater has been the intangible result from his work—namely, that there were multi-million-ton uranium ore deposits to be found. The finding justified high search costs; it was big-time exploration. Deeper drilling, deeper mining with their higher costs were justified by greater targets.

The *Man of the Year in Foreign Mining* was Joseph H. Hirshorn, Toronto, Canada mine developer and financier who financed initial drilling and claim staking at Blind River, Ontario, and in 1956 sold control of his widespread mining interests to Rio Tinto Mining Company of Canada Limited.

Anaconda Company operated the *Pilot Plant of the Year* and at year's end was expanding it to a 50-ton daily capacity at Anaconda, Montana. This plant produces alumina from Idaho clays. Anaconda has optioned substantial clay deposits near Moscow, Idaho, about 375 miles from its Columbia Falls, Montana aluminum plant. The pilot plant seeks a commercial process for an alumina source at competitive cost with imported bauxite.

The *Fastest Growing Mining Company of 1956* was Kerr-McGee Oil Industries, Inc., which entered the uranium mining business in 1952. Since then it has built a mill at Shiprock, New Mexico and found and developed ore bodies in Wyoming, Arizona, Colorado, and New Mexico. In 1956 it located many millions of tons of

ore in Ambrosia Lake and formed Kermac Nuclear Fuels Corporation with two partners. Today Kerr-McGee has just started to grow uranium-miningwise.

The *Most Important Uranium Development* was the extension of the United States Atomic Energy Commission's uranium procurement policy from April 1, 1962 to December 31, 1966. Remember such an extension and improvement of high line purchase schedule were the most wanted things in 1956. High line buying schedules at Moab and Monticello, Utah were modified during the year, so uranium miners got their wishes.

Without question the *Mining Camp of 1956* was Blind River, Canada where three uranium mines are in production, seven uranium mills now building will be in production before year's end, and one mine waits financing. Over \$900,000,000 worth of uranium concentrate purchase contracts have been written, and, by the time you read this, two more companies may have final contracts for an additional \$200,000,000 for concentrates.

One might term 1956 as the year of golden anniversaries because so many companies celebrated their 50th year in business or significant operations had been going on for half a century. Silver anniversaries, too, came in for their share of attention.

In the United States it was the 50th anniversary of the start of open-pit copper mining by power (steam) shovels. It was in 1906 that the first shovel went to work in Bingham Canyon for the Utah Copper Company in what is now the world's largest open pit mine—Kennecott Copper Corporation's Utah Division.

Aktieselskabet Sydvaranger celebrated 50 years of taconite mining and concentrating at Kirkenes, Norway. This operation was described in complete detail in the special Sydvaranger Issue of MINING WORLD in October 1953.

The Vanadium Corporation of America, leading uranium and vanadium miner, had its golden anniversary during the year.

In Australia, the Consolidated Zinc Corporation Ltd. celebrated its golden jubilee of operations at Broken Hill, New South Wales.

Union Minière du Haut Katanga also had a golden jubilee. Operations of this most important copper, cobalt, zinc, and uranium producer will be the subject of a special commemorative issue of MINING WORLD in February.

Roan Antelope Copper Mines Ltd. celebrated its silver jubilee at Lusaka, Federation of Rhodesia and Nyasaland. This mine has produced nearly 2,000,000 tons of copper and is currently producing at the rate of 100,000 annual tons.

During the year there was a decided trend to transportation of pulps, especially concentrates, for long distances through pipelines. One of the notable installations of this was in Uganda, Africa where Kilembe Copper Cobalt Ltd. conveys a copper concentrate and a cobalt-pyrite concentrate through separate lines, largely by gravity, eight miles from mill at Kilembe to a roasting plant at Kasese.

In Canada, Pronto Uranium Mines Ltd., because of terrain conditions, grinds ore in one building and pumps the pulp from the bottom or south end of the crushing-grinding building 800 feet to the head end of the concentration building. Pulp then flows downward through this building. The final result has been lower costs for pumping. Consolidated Dennison Mines Ltd.'s new 5,700-ton-per-day mill, one of world's largest uranium

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World Events Dictate Great Need For Development of Latin American Mines

By CHARLES WILL WRIGHT

The Suez Crisis has once again proven the vulnerability of the long distance sea lanes for imports of mineral raw materials. Suez was "friendly occupation for protection of the canal," not war.

With Russia known to have at least 400 submarines, about double that of the United States, it is self evident that increasing difficulties lie ahead in obtaining key minerals from the Eastern Hemisphere. Fortunately, there are vast opportunities for greater and more intense development of the mineral resources in Latin America.

The vast underdeveloped mineral districts of Latin America, plus the potential of hydro-electric power and available labor supply, present many opportunities for profitable enterprises, in which United States mining companies are now taking a greater interest. The expansion of interest in mine development projects is naturally dependent upon realistic changes in the present mining laws, taxes, and trade policies in several Latin American Republics, as well as adjustments in the United States tariffs.

In most Latin American countries where United States companies have undertaken large-scale developments of mineral deposits, such as in Chile, Peru, Brazil, and Venezuela, both the country and company have benefited. In other republics, however, venture capital hesitates to enter because of political instability, high taxes, and adverse nationalistic tendencies. Also, the security of investment may be threatened by sudden increase in tariffs, import restrictions, or currency exchange controls.

Previous to World War II it was assumed that the importance, defense, and independence of a nation was largely dependent upon the value of its natural resources, the facilities for their development, and the markets for their products. This idea is partly responsible for the rising tide of nationalization, particularly in the mineral industries, as opposed to the broader concept of permitting development and production of mineral resources by foreign capital under private enterprise. In the present world

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situation, protection is not a question for the individual republic, but of all the American republics. Cooperation in the development and use of the mineral resources throughout the Americas is vital for the future welfare and defense of all.

During the past two decades many of the main sources of strategic minerals in the Eastern Hemisphere have been cut off by the "iron curtain" and the present unrestricted flow from sources outside the "iron curtain," such as tin from Malaya, manganese ore, mica, and graphite from India is threatened. There is also an effort by Soviet agents in Latin America to divert certain strategic minerals to countries behind the "iron curtain" and away from the United States. On the other hand, United States mining companies are extending their inter-

In 1953 about 100,000 tons were imported from Mexico and Chile where there are numerous small mines. The output from these mines could be greatly increased.

There are also important manganese ore deposits in New Mexico and Arizona which are being actively developed and which will eventually help to reduce the shortage of this important ore. In view of the vital importance of manganese ore to our steel industry, greater efforts should be made to build up production in the Western Hemisphere, even though United States imports from the Eastern Hemisphere may be continued without serious interruptions.

The United States Government purchase price of \$63.00 per unit of 60 percent tungsten concentrates stimulated output from domestic mines so

"Cooperation in the development and use of the mineral resources throughout the Americas is vital for the future welfare and defense of all."

ests in Brazil, Guatemala, and Chile where their geologists and engineers have already acquired a number of deposits of strategic minerals to meet our industrial requirements.

The accompanying table shows United States production and imports of the principal ores and metals for 1944 compared with those for 1954 and the relative proportions of these imports from the Western and Eastern Hemispheres.

In 1953, United States imports of iron ore amounted to 10 percent, but in 1956 these will be more than doubled. Imports from Venezuela in 1956 will be about 10,000,000 tons from the Cerro Bolivar and El Pao mines.

The supply situation for high-grade manganese ore is most serious. In 1953 United States imports were 20 times domestic output and 77 percent of these were from the Eastern Hemisphere: India, South Africa, and Gold Coast. With the Indian government's high export tariff recently applied on Indian manganese ore, and the transport problems in South Africa, the United States is dependent more than ever on increased supplies from Latin America. Fortunately the large Amapa deposit in Brazil is scheduled to start shipping high-grade manganese ore in 1957 at an annual rate of 600,000 tons.

that United States requirements were largely met. In 1953 domestic consumption was only 7,734,000 pounds of tungsten metal. Bolivia and Brazil are the most important Latin American producers of tungsten concentrates, with minor amounts obtained from Argentina and Mexico.

As Canada produces about 70 percent of the world's nickel and Cuba is becoming an important producer, Western Hemisphere countries are assured of ample supplies. Imports of cobalt, on the other hand, are entirely from the Eastern Hemisphere, chiefly from the Belgian Congo. Domestic production is now supplying about one-half of our needs. Practically no cobalt is produced in Latin America.

In 1954, 97 percent of United States imports of chromite were from the Eastern Hemisphere, namely, the Philippines, South Africa, Turkey, and Rhodesia. There is little reason to doubt that these countries will continue their exports to the United States. In the Western Hemisphere, Montana and California production supplied about 10 percent, and Cuba about 4 percent of needs. The only other source of chromite in Latin America is Brazil, which in 1954 produced 3,000 tons.

During the past decade, in spite of

extensive explorations and development programs, the domestic production has tended to decline in major non-ferrous metals except aluminum. The attached table also reveals that imports of non-ferrous metals from the Eastern Hemisphere have tripled. To meet the growing need of these metals, greater efforts should be made to increase output from the many sources in the Latin American republics.

Starting with *bauxite*, the Americas are entirely independent of Eastern Hemisphere sources of supply, because output of the mines in Surinam, Jamaica, and Haiti is sufficient to meet present import needs. However, since there is a growing demand for *aluminum*, it is important to increase production from operating mines and to endeavor to find new deposits, both in Latin America and the United States. In 1953, 98,000 tons of aluminum metal were imported from Eastern Hemisphere countries, namely West Germany, Norway, Austria, France, Japan, and Switzerland.

As for *copper* the United States ceased being an export nation in 1935 and is now importing 40 percent of its needs. Fortunately the sources in the Western Hemisphere are more than sufficient to meet the needs of our industries and to supply Western Europe with the bulk of that area's requirements. Chile is the main source and Peru will soon become a more important producer than in the past.

Imports of *lead* in 1953 were principally from Canada, Mexico, and Peru, although Australia is another important source. More extensive mineral explorations are being undertaken in the United States to add to lead ore reserves and similar activities in the Latin American countries of Peru,

sure the Western Hemisphere a generous supply of this metal for many decades.

Tin is in very short supply in the Western Hemisphere; in 1954, 75 percent of our requirements came from the Eastern Hemisphere countries of Malaya, Thailand, and Nigeria. Because the principal shipments are from Singapore, consumers are somewhat

Additional similar surveys should include Venezuela; Ecuador, Colombia, Cuba, the Central Americas, and Mexico. The Mineral Attachés in Rio de Janeiro and Lima would naturally be called upon to assist in these mineral resource surveys. With funds available and engineers assigned to the job, this project could be completed in from three to six months.

"If a foreign government desires private financial assistance to develop its mineral resources, it must adopt its economic laws to favor such aid."

apprehensive that this British port may eventually be controlled by Communists. The only important source of tin in the Western Hemisphere is Bolivia, which ships part of its output to England and part to the Government tin smelter at Texas City, Texas. In 1954 Bolivia supplied only 12,575 tons to the Texas City smelter, a decrease of about 6,000 compared with the metal content of concentrates shipped in 1953. In 1954 the tin content of concentrates shipped to the Texas City smelter from Indonesia and Thailand totalled 8,353 long tons.

United States production of *mercury* in 1953 was less than one-half that produced in 1944, while for the same years imports increased four times. Of the 1953 mercury imports, 84 percent came from Italy and Spain. In Latin America, Mexico is the principal producer, with minor amounts from Chile.

It is a well known and often repeated fact that the United States now needs and will continue to need a large portion of Latin America's min-

During such a survey the U.S. Bureau of Mines and local engineers would suggest to the owners of small mines ways to improve their methods of mining and ore treatment in order to increase output.

There are countries in Latin America into which U.S. capital is moving, to the advantage of the country and investing company. However, to attract American capital abroad since there are many opportunities at home for profitable investment without undue risk, the foreign country must offer inducements, such as tax benefits, low import and export tariffs, and favorable exchange controls. There must also be a fair degree of political stability. Certain Latin American countries, namely, Peru and Chile, have already established legislation providing many of these inducements for venture capital.

Peru—Peru's present mining code and laws governing industrial enterprises were passed in May 1950, and shortly thereafter the U.S. Bureau of Mines published¹ details of Peru's new mining code and later decrees. Since that event, hundreds of millions of United States dollars have been poured into Peru's mines and industrial plants and the total amount is increasing each year.

The only tax payable is the regular income tax on net profits. The 4 percent export levy on the products exported is considered an advance on the income tax. All corporations are now subject to the income tax which varies from 7 percent on \$10,000 profits to a maximum of 20 percent on \$100,000 or more profit. In addition, foreign corporations pay a basic 12 percent tax on profits. On bearer shares there is a tax of 15 percent on dividends which is collected at the source. Machinery and supplies for use by the mining industry are exempted from all or part of the import duty. Payment of income tax and land

"There are countries in Latin America into which United States capital is moving, to the advantage of the country and investing company."

Mexico, and Guatemala should find and develop new sources of lead ore.

Some say that *zinc* concentrates are in over-supply, while others believe that the growing demand for galvanized sheet, brass, and other uses will require an increased output of this metal. In 1953 the United States imported 60 percent of its requirements, largely from Mexico, Peru, and Canada. Of interest is the recent development in Brazil which may be the largest known deposit of zinc ore. Several large mining companies have tried to acquire it, but it is owned by a local company which plans to work independent of foreign participation. This discovery and the new finds in Canada during the last few years as-

eral products and that Latin American countries need our markets for their present and future output of these products.

To obtain firsthand information on the principal sources of mineral supply, it is suggested that the U.S. Bureau of Mines employ both American and local engineers in each of the principal mineral producing countries to bring up to date the Foreign Mineral Surveys. This report series was originally prepared by the author in cooperation with the local Mining Bureau and mining company officials in Bolivia, Peru, Chile, Argentina, and Brazil, and published by the U.S. Bureau of Mines during 1940 to 1943.

¹ *Mineral Trade Notes*, Special Supplement No. 35, December 1950. The Mining Code of Peru, and *Mineral Trade Notes*, Special Supplement No. 37, April, 1951. Mining Code of Peru—Modifications.

tax exempts the mining company for 25 years from any further taxes—national, regional, or local—of any kind which are in existence or are promulgated in the future.

Chile—Realizing the need for attraction of foreign capital to invest in Chile's mineral resources and to establish new industries, representatives of the National Bank of Chile, the Mining Bank, the Chamber of Commerce, and the heads of industry introduced modifications of Decree No. 427 which were approved by the Chilean Congress and published in the *Diario Oficial* on July 7th, 1954. This decree offers special dispensations for new foreign capital brought into Chile, namely: (1) Capital invested in a mining venture to be in foreign exchange or in machinery and equipment, the estimated value of which must be registered with the Committee on Foreign Investments. (2) Capital may be withdrawn at any time within five years after entry into the country in annual quotas of 20 percent of the original value. (3) Interest and earnings accruing therefrom can be freely withdrawn from the country without prior authorization of the National Trade Council. (4) All imported machinery and equipment necessary for the activity are exempt from import duties, warehouse fees, and customs taxes. (5) Income produced by the investment shall be exempt from all taxes or charges which may be established during the 10-year period commencing on the date of the publication in the *Diario Oficial*. (6) The enterprises in which the capital is invested are exempt from price controls

or any system of price regulations, for a period of 10 years. (7) These tax obligations affecting foreign capital shall continue without variation under a State guarantee and no new taxes can be applied during the 10-year period. (8) The terms of these exemptions and controls may be extended for 20 years in qualified cases and upon receipt of a statement from the Foreign Investment Committee.

Chile now has a fixed exchange rate of 490 pesos to the dollar. The bank deducts a few pesos when exchanging pesos for dollars and vice-versa. The Chilean Government is to be complimented on its liberal policy toward private enterprise which, without doubt, will help to build up the welfare of the country.

The present situation relative to United States production and its dependence upon mineral imports from the Western and Eastern Hemispheres requires serious consideration so that the needed supplies of ores and metals may be obtained to keep our expanding industries in operation. Our mining companies realize this and are ready to risk investment in Latin American countries where fair treatment is assured. But the companies should also be assured by our State Department that unjust action by local governments will be protested by our ambassadors. In the past, our State Department has been reluctant to give such protection to American companies or investors abroad. American mining companies and investors would welcome fuller cooperation with the State Department in their foreign undertakings.

The State Department now has two Mineral Attachés in Latin America; one in Rio de Janeiro, Brazil, and one in Lima, Peru. Thus the American mining company or investor has an opportunity to get reliable information on mining properties and local conditions within these countries. The Mineral Attachés also report developments in the mining industries, which information is supplied by the U.S. Bureau of Mines to the public through *Mineral Trade Notes*, a monthly public service publication. To speed up aid to American mining interests, as well as to the Latin American republics, it is suggested that the State Department appoint Mineral Attachés for Chile, Argentina, Bolivia, Venezuela, Colombia-Ecuador, Central America, Mexico, and Cuba. Engineers with several years' industrial experience in Latin America are preferable for these assignments.

United States investment firms, mining companies, government agencies, and the World Bank are peppered with reports of new ore discoveries in Latin America. The question arises, where can reliable information to evaluate these stories be obtained? The immediate need to supply information on Latin America's vast sources of mineral supply and on new discoveries is evident, and, as pointed out, this survey could be organized and carried out by the U.S. Bureau of Mines—provided funds are made available for the purpose.

To encourage private investment in new mining and metallurgical activities in Latin America, the International Finance Corporation, recently established under the World Bank, is now ready not only to help finance, but to participate in sound private industry projects, particularly in the metal industries. Such investments do not require a government guarantee, as is the case with World Bank loans.

In this paper the author has attempted to emphasize why the U.S.A. should look to Latin America and to suggest ways and means of encouraging the development of Latin America's mineral resources for mutual benefit. If a foreign government desires private financial assistance to develop its mineral resources, it must adapt its economic laws to favor such aid.

Proof of Latin America's mineral expansion potentialities when backed by a favorable government climate are: Andes Copper Mining Company, and Chile Exploration Company in Chile; Southern Peru Copper Company, and Cerro de Pasco Company in Peru; Bethlehem Steel Corporation, and Orinoco Mining Company in Venezuela.

United States Production and Ratio of Imports For Consumption From the Eastern and Western Hemispheres for 1944 and 1954¹

Commodity	Year	United States Production	Total Imports	Ratio Production-Imports	IMPORTS FROM			
					Eastern Hemisphere	Percent	Western Hemisphere	Percent
FERROUS ORES AND METALS								
Iron ore ²	1944	111,020,145	463,532	42:1	207,988	45	255,544	55
	1953	117,994,769	11,074,035	9.3:1	3,095,481	28	7,975,554	72
Manganese ore ³	1944	247,616	1,315,508	1.5:4	565,006	43	750,502	57
	1953	157,536	3,115,023	1:20	2,397,507	77	718,516	23
Tungsten ⁴	1944	9764	18,239	1:1.9	3,626	20	14,613	80
	1953	9259	57,330	1:6.2	34,410	60	22,920	40
Nickel ⁵ , ⁶	1944	988	116,293	1:118	6,979	6	109,354	94
	1954	2,645	97,263	1:37	11,785	12	85,478	88
Cobalt ⁷	1944	828	4,096	1:5	3,832	94	264	6
	1954	1,996	2,364	1:1.2	2,360	99.3	4	0.7
Chromite ⁸	1944	45,629	848,390	1:13.6	463,741	55	374,649	45
	1954	163,365	1,470,069	1:9.6	1,432,490	97	37,579	3
NON-FERROUS ORES AND METALS								
Bauxite ⁹	1944	3,162,573	627,716	20:1	0	0	627,716	100
	1953	1,579,739	4,388,623	1:2.7	0	0	4,388,623	100
Aluminum ¹⁰	1944	776,446	1,051,753	7.3:1	0	0	102,753	100
	1953	1,255,013	332,060	26:1	98,064	30	234,796	70
Copper ¹¹	1944	972,549	784,311	1.2:1	71,871	9	712,440	91
	1953	926,448	677,069	1.4:1	173,927	22	503,142	78
Lead ¹²	1944	394,443	316,186	1.2:1	31,670	10	284,766	90
	1953	328,012	545,869	1:1.7	198,680	36	347,189	64
Zinc ¹³	1944	579,453	486,322	1.2:1	46,096	9	419,646	91
	1953	495,436	747,959	1:1.5	145,803	18	602,156	82
Tin ¹⁴	1944	5	48,886	21,064	43	27,822	57	
	1954	205	87,692	1:43	65,552	75	22,140	23
Antimony ¹⁵	1944	4,735	10,918	1:3.5	0	0	16,918	100
	1954	766	8,722	1:11.4	3,317	38	5,455	62
Mercury ¹⁶	1944	37,688	19,553	1.9:1	0	0	19,553	100
	1953	14,337	83,393	1:5.8	69,918	84	13,475	16

¹ Where U.S. Bureau of Mines statistics for 1954 are not available, 1953 data are used. ² Long tons. ³ Short tons. ⁴ 1,000 pounds. ⁵ Nickel import statistics have been confined to those of new and manufactured nickel. ⁶ Flasks.



REGISTRATION at the 62nd annual Northwest Mining Convention, held last month in Spokane, Washington, was larger than ever this year. Shown above is a group of delegates at the registration desk picking up tickets for the many events. Miners nearly took over the Davenport Hotel, lock, stock and barrel, as evidenced by picture at left which shows the lobby where evening banquets were held.

Northwest Miners Close-Out Year With Two Day Convention in Spokane

One fact stood out at the sixty-second annual convention of the Northwest Mining Association, held last December in Spokane, Washington. Over and over, responsible men in industry stressed the importance of research in the normal growth and development of the minerals field. Blunt-speaking H. M. Bannerman, assistant chief geologist of the United States Geological Survey in the opening session, emphasized the need for increased study of present ore-search techniques together with full development of new methods for finding ore deposits. Yet he produced figures which showed that the mining industry ranked near the bottom of all industries with regard to actual expenditure of dollars for research in all fields as a percentage of gross sales of product.

The importance of research was referred to by Marling J. Ankeny, director of the U. S. Bureau of Mines with specific examples relating to the Bureau's work in the Northwest on chromite, on clay processing to extract the alumina content, utilization of phosphate rock and a host of other instances of research. Nor were government officials the only individuals to prod the convention audiences for increased research. From Canada, D. D. Morris, assistant to the general manager of Consolidated Mining and

Smelting Company, Ltd., Trail, British Columbia, using a hypothetical example showed in dollars and cents how scientific discovery could benefit the mining company. And in the technical sessions the fruits of research and technologic development were apparent. A look at the program reveals that such subjects were treated as rotary-percussion drilling, an experimental phosphate planer, a program for possible utilization of domestic chromite, use of yieldable mine arches for underground support, and mine dust control.

Bigger Than Ever

Once again a new attendance record was set. A total of 675 mining men registered and this count was swollen by many wives who registered for the ladies' activities. Karl W. Jasper was again re-elected president of the Northwest Mining Association and will head the group during 1957. In keeping with the Association's policy of offering mining and metallurgical students from nearby colleges and universities a reduced package registration rate, many future engineers were in evidence at the meetings. Every year the activities grow and each minute is packed with meetings,

or luncheons, breakfasts and dinner banquets. The annual Sourdough Breakfast which features a "Moose Milk" starter was so jammed that emergency tables and chairs had to be provided at the last minute.

Delegates were welcomed to the convention by Karl Jasper who later let go a blast at a proposed dam on the Pend Oreille River which he said could seriously affect one of the nation's largest reserves of lead-zinc (the important Metaline mining district). He was followed by Mr. Ankeny, of the Bureau of Mines who summarized various research projects of the bureau in the Northwest or relating to Northwest problems. "One area of the Bureau of Mines research which may prove of particular value to the Northwest is that directed toward the production of aluminum from clays and other offgrade material," said Mr. Ankeny. In this connection it is interesting to note that the Anaconda Company has actually announced the development of an alumina-from-clay process and is building a \$1,000,000 pilot plant for further study.

On Geophysics

According to Mr. Bannerman consumption of our mineral resources is

outstripping production. Continuing, he said that much greater support will have to be given to research in earth sciences, and more effort expended on exploration in the future if the mining industries are to keep pace with demand. Taking a look at his figures showing a very low expenditure of funds for research in mining as compared to other industries, Mr. Bannerman found comfort in these recent trends. (1) Long range exploration programs initiated by some of the large mining companies; (2) general awareness on the part of the government that a state of imbalance exists between ability to discover new deposits and extraction of present mineral resources; (3) development of new techniques for ore search among which are geochemical prospecting, better geologic mapping along with the use of photogeology which cuts down on the need for ground control in surveys, and the host of motorized, precision-measuring and recording instruments for geophysical application.

At a noon luncheon, Norman Krey, manager Northwest operations, Kaiser Aluminum and Chemical Corp., reviewed a trend which has been apparent in the aluminum industry. New plant capacity is using steam power rather than hydro-electric power. Two chief reasons he cited for this change is the unavailability of low-cost hydro-generated power in the west; and high freight costs on aluminum feed and shipment of refined product. Savings are possible by locating new plants nearer to the source of supply of alumina or close to the Eastern markets.

Uranium

The 14 year history of the Atomic Energy Commission was traced by Robert Nininger, assistant director for exploration, division of raw materials, Atomic Energy Commission. He described 1956 as a year of development of previously discovered deposits; and also as the first year of a new stage where the industry looks beyond the military market to the more permanent industrial usage. United States reserves of uranium are set at 30,000,000 tons with an additional 30,000,000 tons of potential ore in June of 1956. Much of the potential ore has been moving into the inferred or indicated category in the last half of the year however. Production of ore in June of 1956 was 3,000,000 tons and is expected to reach 5,000,000 to 6,000,000 tons.

Also included on the Friday program were James E. Newton, regional administrator, Securities & Exchange Commission, Seattle, Washington; W. L. Shafer, assistant minerals staff

What Policies Are Favored For Mining?

The 62nd Northwest Mining Association in Spokane went on record as favoring the following resolutions.

On Public Lands The Association Favors:

(1) Broadening the "discovery" provision of the General Mining Laws and seeks a reasonable period of protection for those who, in good faith, seek a discovery.

(2) Making assessment work cumulative to the extent of one year for each \$100 in excess of \$100 per claim for the current year, but not cumulative in excess of five years after the year in which the work was performed.

(3) Changing the dates for completing annual assessment work from July 1 to October 1. This provision would be advantageous to owners of claims located in high, snow country.

(4) Providing for forfeiture of a claim if assessment work is not performed and recorded with the county recorder within the end of the fiscal year (now July 1); and forbidding relocation of a forfeited claim by the owner for a specified number of days after termination of the recording period.

(5) Permitting the location of a 40-acre legal subdivision on sub-divided land as a single claim without extra lateral rights and without need for special survey for patent; this resolution is designed to eliminate the costly nature of surveying lode claims for patent.

(6) Revision of the present law regarding roadside strips, recreational areas and administrative sites so that withdrawal of public lands for these purposes by the Forest Service or Bureau of Land Management will not make the sub-surface mineral resources on these lands unavailable. Under the existing law withdrawal of the surface rights only of the above lands is impossible, and entry to sub-surface mineral is thereby prevented.

(7) Changing the law now permitting a lessee to hold 10,240 acres of phosphate, but not over 5,120 acres in any one state, so that the lessee may hold the 10,240 acres without restriction by state boundaries.

On Public Lands The Association Opposes:

(1) Any extension of the Leasing Act system to minerals and metals locatable under the General Mining Laws.

(2) Any general cession to the various states of any rights in public domain lands that would interfere with mining locations under the General Mining Laws.

The Association went on record as wholeheartedly advocating a currency backed by gold and silver and recommends that:

(1) Restrictions on the purchase, ownership and sale of gold and silver by United States citizens be abolished.

(2) The Treasury be required to purchase at the monetary price all newly mined domestic gold and silver tendered by producers.

(3) All present stocks and future acquisitions of gold and silver be utilized by the Treasury for monetary purposes only.

(4) Congress fix the ratio at which the dollar and gold are to be made fully convertible and determine other technical procedures in the restoration of the gold standard;

(5) The Federal Administration aid other governments in restoring gold and silver coinage as a circulating medium;

To prevent the drying up the flow of capital to the mining industry resulting from unwise taxation, the Association recommends that:

(1) The overall tax rate on income of the individual or of a corporation should not exceed 50 percent and in due course should be reduced to not more than 35 percent.

(2) Exploration expenditures should be fully deductible and present limitations removed.

(3) Full and adequate allowance for percentage depletion should be provided for all minerals on a fair and equitable basis, not less favorable than present rates.

(4) New mines should be exempt from income taxes for three years after commercial production begins.

(5) Inter-corporate dividends should not be doubly taxed, therefore the limited allowance now made to stockholders on dividends with respect to taxes paid by the corporation should be further increased.

(6) Depletion allowance should be extended to dividends received from mining companies.

(7) A reduction of the rate on net long-term capital gains would economically benefit the mining industry, and would increase net revenue collected.

(8) Depreciation allowances under the provisions of the Internal Revenue Code of 1954 should be continued.

The Association went on record as opposing all efforts to repeal the Taft-Hartley Law and also favored legislation designed to limit the use of union funds for political purposes.



WELCOMING H. M. Bannerman, Assistant Chief Geologist, United States Geological Survey, (right) to convention is Karl Jasper, President of the Northwest Mining Association.



SWARMING out into the hotel lobby following convention sessions, the delegates gather in groups to discuss various aspects of the different meetings and where to go next.

officer, Bureau of Land Measurement; and William C. Aitkenhead, Director, mining experiment station, Washington State Institute of Technology at Washington State College. Mr. Aitkenhead reviewed briefly a new electrolytic zinc plant recently completed in Yugoslavia which he visited as a United Nations technical expert. Describing the plant as closely similar to the Corpus Christi unit of American Smelting & Refining Company, he said that production amounted to 32 metric tons per day. He also reported that several operations in Yugoslavia are floating oxide zinc ores.

Canadian Mining

During a session on Canadian mining, Walter I. Nelson reviewed activities in the promising Highland Valley and Kamloops copper areas of British Columbia. Bethlehem Copper Corp. is now sampling copper ore occurring in breccias in the Highland Valley area. He said that resistivity surveys have been used in the Kamloops copper district. During the same program D. D. Morris from Consolidated Mining and Smelting Co. used a hypo-

thetical mine with lead-zinc-iron-sulphide ore and producing 1,000 tons of ore per day to illustrate how research and process development would spearhead the growth of the organization. He used as yardsticks for measuring growth the power consumption of the enterprise, the labor employed, the capital growth and the product output. For instance Mr. Morris showed what effect development of the differential flotation process might have; what the application of electrolytic zinc recovery would mean in dollar and cent growth and how several other advances, including recovery of SO₂, would benefit the company.

Technical Sessions

In a mining session T. E. Howard of the Bureau of Mines described the experimental phosphate planer developed by the Bureau. H. R. Swingle of Ingersoll-Rand Company talked on rotary-percussive drilling, and E. B. Olds described ventilation at Bunker Hill Company's Crescent mine. G. P. Mahood developed information on Bethlehem Steel Corporation's yield-

able mine arch sets. Incidentally the sets have found application in some of the Northwest mines. Will the United States ever sustain a self sufficient chromite operation? No one knows but William Foster of American Chrome Company said that his company is devoting a great deal of attention to that problem.

In other sessions, F. M. Monninger general plant foreman, The Anaconda Company, Yerington mine, illustrated leaching and cementation practice at the Yerington mine. E. B. Shea described the development of the Berkeley open pit at Butte and W. C. Cole reviewed the geology of the Blackbird mine of Calera Mining Company.

Charley Steen braved inclement flying conditions to get to the convention and vigorously say in essence —there is no need to change our basic mining laws. He claims that certain interests would like to amend the present laws to permit withdrawing large areas for geologic investigation without staking claims. Mr. Steen feels that this would freeze-out the small prospector. Right or wrong he left little doubt as to his position on the matter.



FEATURED SPEAKER at a Friday luncheon was Norman L. Krey, Manager Northwest Operations, Kaiser Aluminum & Chemical Corp. In the center photo is Marling J. Ankeny,

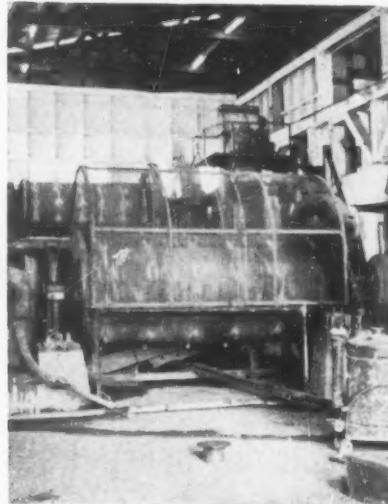


Director, U. S. Bureau of Mines, a speaker at the opening session. Early morning coffee provided by ladies auxiliary, at right, was a welcome relief for many convention delegates.



I saw them in the Philippines, too!

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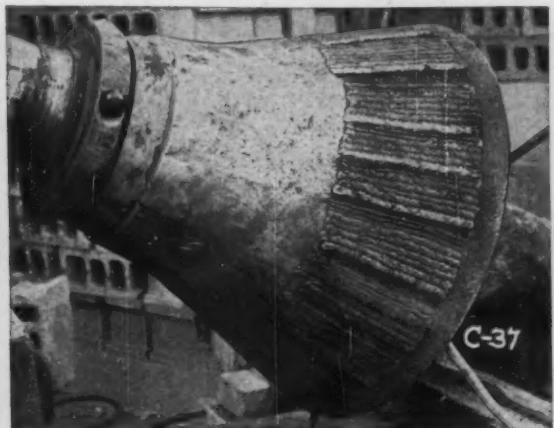
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You protect personnel—and mining equipment—against falls, crushes, bumps and other back, face and rib failures when you use CF&I Rock Bolts. What's more, this dependable, increasingly-popular roof support method eliminates timber supports and never blocks service openings such as airways and manways.

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Slot-And-Wedge Type—which is driven into place and has excellent load-carrying capacities.

Expansion Shell Type (with Pattin Shell)—which requires no driving with pneumatic equipment and is available in both left hand and right hand threads.

Both types can be used with Realock Chain-Link Fabric for metallic lagging as illustrated.

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Euclid's Model TC-12 Twin-Power Crawler establishes an entirely new standard of tractor performance. It's built to deliver unequalled drawbar horsepower, easy operation and a smooth, steady flow of power to meet any job requirement. It provides easy accessibility of all major components and all lubrication, check and adjustment points are located for maximum convenience. Unitized assemblies permit service or removal without a major tear-down of other parts.

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FOR MOVING EARTH, ROCK, COAL AND ORE





1956 has, in many respects, been a record year for us... characterized by advances in technology and an all-time high in volume of new orders and also billings throughout the world. This meant a year of strenuous adjustment due to the necessity of increasing our productive capacity to parallel our growing volume of business.

The acquisition of the Merco Centrifugal Co. of San Francisco on February 1, added centrifugals to our product line. This natural outgrowth of our cyclone work has proven to be a most successful move. Similarly, the year has demonstrated the strength of our new Canadian subsidiary, Dorr-Oliver-Long of Orillia, which became the newest member of our corporate family on January 1, 1956. Yet another step in the overall corporate growth picture was the completion of plans to add the ninth member of our overseas family, Dorr-Oliver Pty. Ltd. of Australia on January 1 of 1957.

Steps in matching our productive capacity to our growing needs included a million dollar expansion of our Hazleton plant scheduled for completion at the year's end and the opening of a sizable new production facility nearby in Pennsylvania. Currently, long term expansion and reallocation program is underway which will step-up our ability to produce, and to serve, still further.

Growth and change in other operating areas of the parent company also kept pace.

A broad reorganization of our domestic sales structure added new geographical divisions and was principally designed for better sales coverage and service. In engineering, the pressure of increased volume resulted in the opening of a branch engineering office in Pennsylvania, close by our East Coast plants, which has proven to be most worthwhile.

FERTILIZER — One of the highlights of the past year was the largest single D-O order ever received involving a phosphoric acid and 200,000 ton per year triple superphosphate plant for a Florida producer. The scope of our services on this project includes architect-engineer design, supply of equipment and construction materials, and supervision of erection and initial operation of the plant.

Other major design projects undertaken during the year were a 350,000 ton per year complete granular fertilizer plant in Great Britain, a 350 ton per day ammonium phosphate installation in Montana, and a phosphoric acid plant for Venezuela designed to produce 50 tons of P_2O_5 per day. During the year construction of a D-O engineered Scottish granular fertilizer plant was virtually completed, and Traveling Pan Filters were ordered for the difficult gypsum-phosphoric acid separation in a number of new chemical fertilizer plants around the world.

SANITATION — The new Spirovortex-Superate Filter will produce a degree of purity comparable to that attained using the activated sludge process in plants treating up to one MGD of domestic sewage. We have developed the Degritting Clarifier and Clari-gester for low cost grit removal in small plants and during the year we have incorporated important new features into the design of our Vacuum Filters for the sanitary field.

The completely D-O equipped sewage treatment plant for Karachi, Pakistan, represents the largest order in the sanitary field ever entered by our associates in The Netherlands. Typical of other new D-O equipped installations are those under construction in such diverse locations as Charlottesville, Virginia; Caldwell, Idaho; Midwest City, Oklahoma; Delhi, India; Nairobi, Kenya; and Rio de Janeiro, Brazil. Expansion of Providence, Rhode Island, treatment facilities calls for installation of nine Dorr Clarifiers, all over 100 feet square, and at Louisville, Kentucky, four 275 foot long Monorake units will be added.

METALLURGICAL — Recently placed on the market, the DSM Screen is an ingenious, high capacity screen capable of separations as fine as 200 mesh. Adapted from the Dutch design, the unit has operated very successfully on coal and will handle a wide variety of non-fibrous feed slurries. Other highlights of the year include a number of Thickener-Filter combinations and Bowl Desilters installed in Eastern coal fields, a D-O equipped iron ore washing plant in California, and a variety of cement plant expansion equipment orders.

RESEARCH AND DEVELOPMENT — As a matter of policy, fundamental research continues on our expanding line of basic unit operations. The principle of operating in many different but allied fields stimulates situations wherein fundamental research can produce new and useful products and processes. Such is not possible when interest is confined to but a few basic operations, as in our early years.

Similarly, general company development is continuing the search for new products allied in some manner with our experience and facilities. In this search we count heavily on the assistance and cooperation of our Associates throughout the world.

ALUMINA AND MAGNESIA — Plant expansions in both fields contributed heavily to the year's business as four of the world's major alumina producers in the Gulf Coast area and Jamaica ordered a total of 45 Filters, 20 Thickeners and 26 low pressure pumps of various types and sizes. In Michigan, three magnesia-from-brine plants will add a variety of agitation, filtration and thickening equipment; while a West Coast magnesia-from-sea water producer will employ extensive D-O equipment.

POLYETHYLENE — Our contribution to one of today's most spectacular and rapidly growing fields — polyethylene — is the Merco Pressure Centrifuge, developed specifically for high pressure, high temperature operation. The basic unit was developed, designed and manufactured in record time to keep pace with the expanding industry. First commercial Centrifuges will go on stream early in 1957 separating catalyst from liquid polyethylene.

FLUOSOLIDS SYSTEMS — A large steel producer in the United States finalized plans for a new fine coal washing plant using a two Reactor FluoSolids Coal Drying System designed to handle 600 tons of metallurgical coal per hour. In the non-metallurgy field, three fluidized Reactors went into operation — two in the Detroit area drying blast furnace slag used in cement manufacture, and the other calcining clay in Scotland. Systems are now under construction to dry and pre-heat oyster shells and to calcine Massachusetts limestone.

Four new installations in Japan will roast 265 tons of zinc concentrates daily, producing both a readily usable calcine and SO_2 -bearing gases for contact sulfuric acid manufacture. During the year two installations in the U. S. and South Africa operated successfully roasting copper for direct electrowinning. And pyrite roasters were ordered for a Canadian uranium mill, Chilean and Nicaraguan copper concentrators, French and Philippine fertilizer plants, and two Scandinavian pulp mills. In all, 21 fluidized Reactors were sold in 1956.

URANIUM — Four new or expanding uranium mills in the United States and Canada will employ a wide variety of types and sizes of Agitators, Thickeners and Classifiers to perform the various leaching, dewatering and classification steps. One of these — a West Coast installation — will also install a d-i system to concentrate and purify uranium bearing solution.

INDUSTRIAL WASTES — D-O equipped treatment plants handling chemical wastes were installed by a German and two British chemical manufacturers. The former installation incorporates the first D-O equipment to be purchased for this purpose in Germany since World War II. Next year two Southern pulp mills will clarify wastes in giant 300 foot Thickeners installed in earthen basins, and a U. S. steel company will recover flue dust in a completely D-O designed installation. Two similar flue dust recovery stations were also ordered from our British subsidiary during the year.

The year's impressive record of sales and technical accomplishment has been made by the hard work of our staff in every corner of the globe. The success of our operations naturally rests wholly with them, despite the importance of the tangible facilities and tools with which we work. In the year now drawing to a close this was again demonstrated, and as the tools and facilities we give them expand and become of better quality, so will our staff be able to produce greater volume and increasing returns.

J. D. HITCH, JR.
President
November 20, 1956

GALIGHER ACID-PROOF SUMP PUMP

stands on such challenging records as this:

An installation of four Galigher Sump Pumps at a Colorado mill has just completed 10½ months of continuous operation handling abrasive material without an hour of shut-down for repairs. This record is typical of the dependable on-the-job service being delivered at scores of other mills where uninterrupted pumping is vital.

Handling slurries, corrosives, froths and flotation products, as well as mill cleanup is the specialty of Galigher Sump Pumps. These sturdy pumps are ideal for many services in metallurgical centers everywhere. In addition to the non-air-locking feature, they are capable of pumping solutions containing a high percentage of solids.

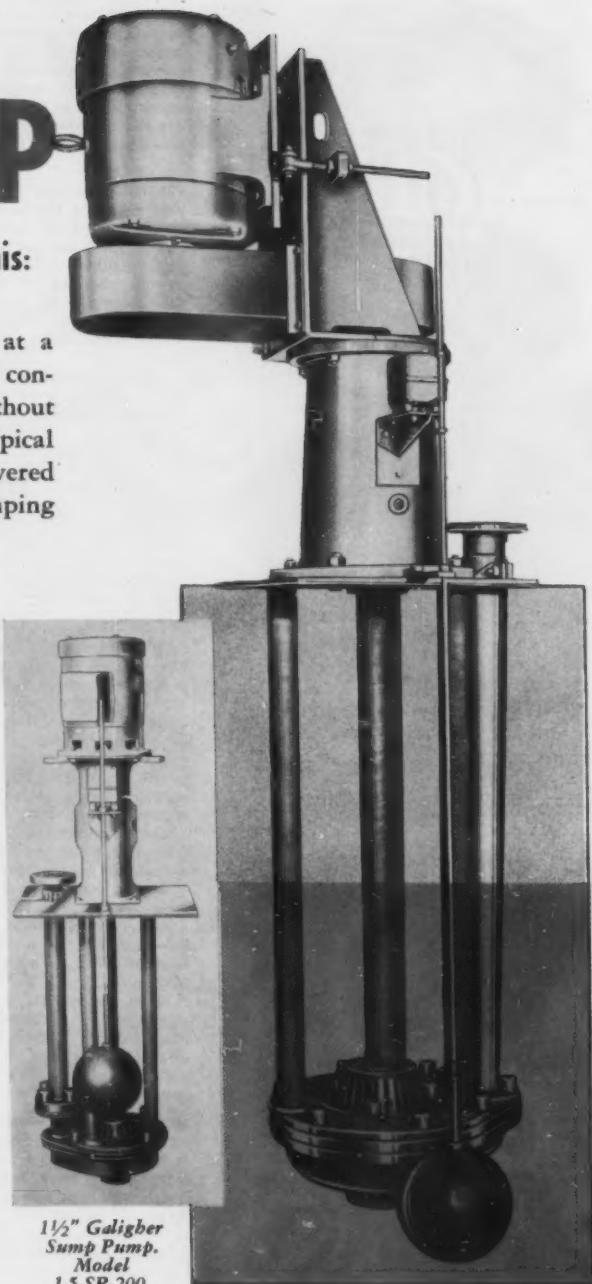
A Galigher Sump Pump model for any kind of service

Standard models, neoprene and rubber covered. Special models available in all iron or alloy construction for particular application.

1½" capacity . . . 10 to 100 GPM . . . heads to 40 ft.
2½" capacity . . . 20 to 250 GPM . . . heads to 65 ft.
Designed for intermittent or continuous operation.
No seals, packing or submerged bearings.

We also manufacture the well known VACSEAL Pump for material handling and corrosive solutions. Sizes 1½" to 8", capacities—10 to 3600 GPM.

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GALIGHER PRODUCTS: AGITAIR® Flotation Machine, VACSEAL Pump, Geary-Jennings Sampler, Acid-proof Sump Pump, Geary Reagent Feeder, GAL-CLONES, Laboratory AGITAIR® Flotation Machine, Laboratory Pressure Filter, Laboratory Ball Mill, Rubber Lined and Covered Products, Plastic Fabrication.

Speed and Mobility

get more work done!



Tournatractor takes the shortest route to job... via highway or cross country... cuts hours from job-to-job moves.



208 hp Tournatractor with PCU on rear can be hooked up to pull scrapers, rooters, and rollers.



Rubber tires do not damage rails or ties... unit can switch up to 10 fully-loaded railroad cars at once.

Whenever your application involves scattered assignments, Tournatractor's 17 mph forward speed cuts moving costs and reduces the non-pay hours of moving time. Big, low-pressure tires let you drive Tournatractor anywhere. For long moves, you save time, bother and expense of moving in transport equipment and extra men to help load and unload.

Speed on the job

Tournatractor pulls, dozes, pushes at working speeds 2 to 3 times faster than crawler tractors. You have 3.69 mph in second gear, 8.38 mph in third, compared to crawler speeds of around 2 mph in second, and 3 mph in third. Tournatractor travel speed of 17.39 mph compares to the crawlers' top ranges of 4 to 6 mph.

8 mph reverse speed

High reverse speeds give a very important time-saving advantage to Tournatractor. Nearly 50% of your working cycle on dozing or pushing is spent backing up. Crawler highs in reverse range from 3.1 to 6.2 mph. Tournatractor high in reverse, 8 mph.

Instant shifting

Constant-mesh transmission aids high-speed performance by eliminating delays in changing gears, saves vital momentum, gives you any gear ratio instantly. Torque converter increases this advantage by giving wide automatic over-lapping of gear ratios, without depending on operator to ad-

just levers for the most effective ratio of power and speed to load.

Ample flotation and traction

Big tires, 2 feet wide, stay on top of soft ground instead of digging in. Lugs bite into underfooting to give traction. Tire pressures as low as 20 lbs. absorb shock. Rolling action compacts loose materials far more effectively than crawlers.

Lower maintenance

There are 4 wheel assemblies compared to more than 500 wearing parts in standard track-assemblies. This means much less maintenance.

Easier to operate

Steering, raising and lowering the blade, and operating the power-control-unit, are all handled by simple electric buttons on the dashboard. There are no levers, wheels, or other manual controls to handle.

Interchangeable equipment

Adding to Tournatractor's versatility are a number of interchangeable attachments... Bulldozer, Angledozer, Root Rake, Snow Plow. This versatile tractor can also be equipped with a Push-Block, Logging-Winch, or Tree-Pusher for additional applications. Drawbar and PCU are available for hauled equipment.

Find out for yourself how Tournatractor's mobility and 17 mph speeds can help you get more work done. Write for complete information.

Tournatractor, Angledozer—Trademark Reg.
U.S. Pat. Off. T-926-G-bw



LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

The Engineer's Field Report

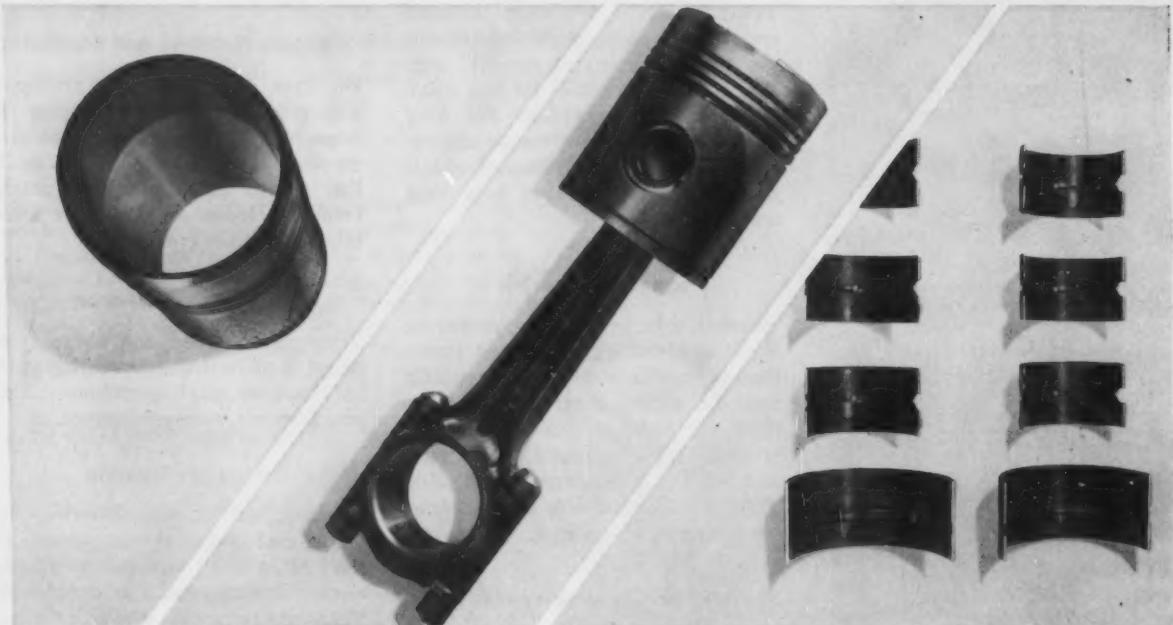
CASE HISTORY

RPM Delo Oils

LUBRICANT

Progressive Transportation Co,
FIRM Compton, California

RPM DELO holds piston wear to .001" after 201,253 miles of on-and-off highway hauling



LUBRICATED WITH RPM DELO Oil, these engine parts were pulled from a Cummins HR diesel after 201,253 miles. A portion of this mileage was put on during four months of rugged service spotting loads of heavy pipe in the Arizona desert. When the engine was taken down, after two years of this on- and off-highway hauling, Progressive Transportation Co. found RPM DELO Oil had kept lacquer, gum, sludge, and deposits from forming...rod bearing wear varied between .0005 and .001 inch and pistons showed maximum wear of only .001". No wear at all evident on

main bearings. Progressive Transportation uses RPM DELO Oils in all its large fleet of tractors—some of which have traveled well over 200,000 miles without overhaul.

Why RPM DELO Oils prolong engine life

Special com-
pounds stop
corrosion

Anti-oxidant
resists lacquer
formation

Detergent
keeps all
parts clean



Metal-adhesion qualities keep oil on parts in running or idle engines—inhibitor resists foaming



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Mining clay for gloss coating of quality magazine papers

Thiele Kaolin Co., Sandersville, Georgia, supplies kaolin to coat paper for *Life* magazine and for quality papers from mills across the country. To get this kaolin, Thiele is working a 30-acre pit, using 2 draglines, a $\frac{3}{4}$ -yd. shovel, and an 11-ton D Tournapull Rear-Dump.

At one end of the mine, a dragline with 6-cu. yd. bucket strips overburden. As the kaolin is exposed, the dragline digs this material and dumps it in stockpiles according to grade.

It is necessary that the various grades of kaolin be carefully blended to produce the final quality specified by the ultimate users. To accomplish this "mixing", a $\frac{3}{4}$ -yard shovel loads "lean" kaolin into the D Tournapull Rear-Dump, which hauls it to other "rich" stockpiles near a mixing hopper. Here a second dragline mixes and loads the kaolin into the hopper. The material is mixed with water and forced by pressure-pump through a pipeline to the mill.

Averages 42 loads a day

At the time these photos were taken, the $\frac{3}{4}$ -yard shovel was loading Tournapull Rear-Dump with approximately $7\frac{1}{2}$ yards of kaolin in about $2\frac{3}{4}$ minutes. The average 500' haul from the "lean" pile to dumping area was deeply-rutted, wet, and slippery. Although some

of the ruts were 2' deep, rig's haul-time averaged only $1\frac{1}{2}$ min. It took Rear-Dump less than a minute to turn, back into position, and dump. Rig completed average 1000' cycle in 6 min. 20 sec. . . . hauled 38 heaping loads in $6\frac{1}{2}$ hours. Rig averaged 42 loads per 8-hour day, depending on mill requirements.

Replaced 2 trucks with 1 Rear-Dump

Originally, Thiele used 2 trucks, but replaced them with the one D Tournapull Rear-Dump. According to Supt. Owen E. Robbins, "One-man operation suits me! We like Rear-Dump's ability to get through mud where trucks couldn't go."

Power-transfer differential and power-steer, speed hauling

With Tournapull prime-mover's exclusive power-transfer differential, which automatically applies power to wheel on firmest footing, the heavily-rutted and slippery underfooting is no problem. Positive power-steer adds to Rear-Dump's tractive power, because it lets operator pivot prime-mover from side-to-side to "walk" machine out of tough going.

Increase production . . . cut costs

According to Mr. Robbins, a saving of 75% in fuel, and 50% in lubricating oil was effected when 2 trucks were replaced by one D

Rear-Dump hauls heaped loads over deeply-rutted mine floor. Rig keeps going steadily through soft footing, takes minutes off each cycle... hauls up to 42 loads in one day!

Low rear-entry and wide bowl provide easy target for shovel operator... make for fast swingout of shovel dipper, let operator heap maximum yardage with minimum spillage.



At touch of electric switch, body lifts, swings below and behind rear wheels... prevents material from piling under unit.



Tournapull Rear-Dump. Changing from trucks to Tournapulls, Thiele Kaolin reduced operating costs and increased production. Rear-Dump provides uninterrupted service in these mining operations.

Looking for a way to save money?

If you have a hauling problem of any kind, investigate Tournapull Rear-Dumps . . . available in three sizes: 11, 22, and 35-ton capacities. Send for detailed information.

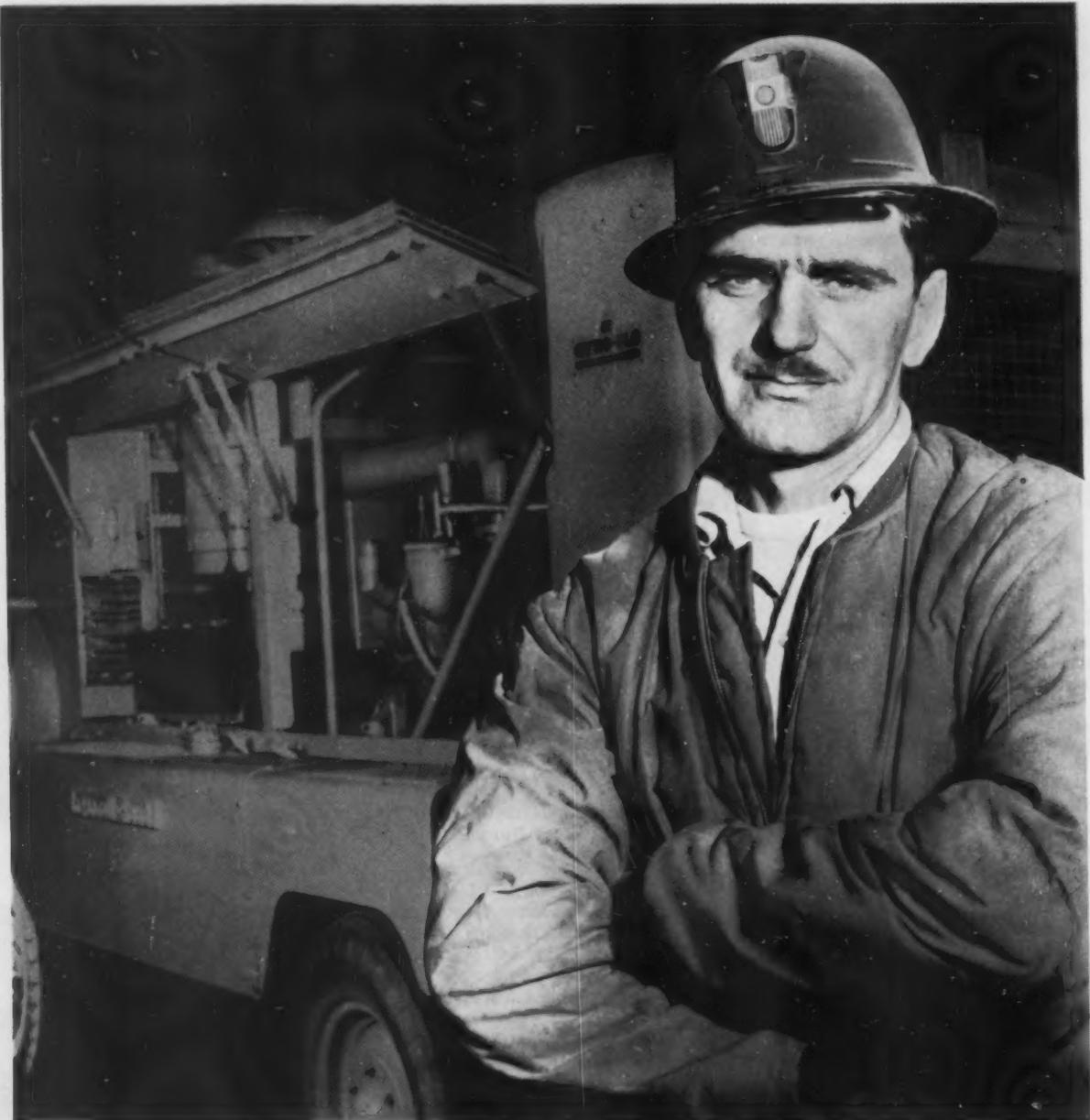
Tournapull—Trademark Reg. U. S. Pat. Off. DR-1062-M-bw



LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company



Ned Fillip, Benton Division, Wah Chang Mining Corp., Bishop, California

"T5X licked the carbon problem here"

"Until we started using T5X Motor Oil in our diesel-powered compressors we experienced a great deal of trouble with stuck rings and clogged up ports due to formation of hard carbon deposits.

"T5X licked this carbon problem for us here and has substantially reduced our maintenance costs and down time."

As Mr. Fillip has found, T5X is ideally suited for heavy duty diesel lubrication. If carbon is a problem

with your diesel equipment we suggest you ask your nearby Union Oil representative for amazing T5X Motor Oil.

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OF CALIFORNIA

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Dallas: 313 Fidelity Union Life Bldg. • **Kansas City, Mo.:** 612 W. 47th St.
New Orleans: 644 Nat'l Bank of Commerce Bldg. • **Boston:** 214 Harvard Ave.



Haul heavy loads out of pit through soft, shifting sand

How would you solve the problem of hauling heaped loads of aggregate through shifting sands? That's the challenge that faced South Shore Ready-Mix, Deer Park, Long Island, New York, when they had to move big quantities of sand for volume concrete production at their Brentwood, Long Island sandpit. South Shore solved the problem with their 293 hp, 25-yard B Tournapull... using it to profitably haul heaping loads of sand from the pit to a screen-feed hopper.

Hauls through soft, powdery sand
In the sand-pit, B Tournapull is shovel-loaded with sand. Wide scraper bowl makes big, easy target for shovel operator. Powerful 2-wheel tractor... riding on big 7' high, 2' wide tires... hauls heavy load through soft, shifting pit-bottom. Rig, rolling on wide-spreading, low-pressure rubber tires does not

bog down in this soft footing, feeds screen-hopper at plant on regular schedule.

Power where you need it

There are 3 big reasons for B Tournapull's success in soft, sandy going: 1) big, low-pressure rubber tires with 2' wide treads, 2) its exclusive patented power-transfer differential, 3) electric power-steer through geared kingpin.

Tires provide necessary flotation and traction in sand, without digging in. Exclusive torque-proportioning differential automatically equalizes power applied to both drive wheels, for better traction and control, with a minimum of wheel slippage. Positive-power steer pivots prime-mover from side to side to "walk" machine out of soft spots... moves trailing unit ahead with each "step" of the prime-mover.

With choice of 10 speeds, operator can always match "B's" speed and power to haul road conditions. With low-gear range, and clutch-brake for fast shifting, he can haul at higher average speeds, and deliver more yards per hour.

B Tournapull hauls sand from pit, dumps load in screen feed hopper at South Shore's Brentwood, Long Island, N.Y., plant.

Big-capacity 25-yard B Tournapull is shovel-loaded at South Shore Ready-Mix's Long Island, N.Y., sand-pit. Wide scraper-bowl lets shovel operator load "B" quickly, easily.

These exclusive Tournapull features sold South Shore on use of the "B" over conventional trucks — which could never have hauled out of the soft pit bottom. Once stalled, trucks have no way to pivot drive-wheels to walk vehicle out of sand. And small duals would bog down hopelessly. Big-tired Tournapull, on the other hand, pulls through where other machines stall... hauls loads where others can't go through empty.

Fast, safe, easy to operate

With simple, safe, weather-proof, electric controls, operator handles the powerful "B" easily, with less end-of-shift fatigue. Machine travels from pit to hopper site fast...at speeds up to 28 mph. Good visibility, low center of gravity, and big disc-type air-brakes on all 4 wheels make Tournapull safe to operate in the soft, sandy going.

Interchangeable trail units increase profits

South Shore has another advantage in the "B" scraper they use for hauling. At any time, same "B" prime-mover can pull interchangeable 35-ton Rear-Dump. For a fraction of the original investment, extra trailing units could help double the earning power of the 'Pull; keep it busy hauling shovels rock or other materials in the off-season. Both work units use same wheels, tires, brakes, and electric controls. Change takes just a few hours.

Low-cost...big production

Look into the profit advantages of these BIG, 25-yard, 293 hp Tournapulls for your big-yardage assignments. Besides the "B", there's the new 18-yard, 208 hp Fullpak "C", and the 9-yard, 138 hp "D".



Fullpak—Trademark, Tournapull—Trademark Reg. U.S. Pat. Off. BP-957-S-b

LeTourneau-WESTINGHOUSE Company
Peoria, Illinois

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**COPPER, GOLD
AND SILVER ORES**

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SUPERIOR, ARIZONA**

**International
Smelting and Refining Co.**



Buyers of

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Copper Smelter—Miami, Arizona
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International Smelting and Refining Co.
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Miami, Arizona

Lead & Zinc Ores
and Concentrates

Lead and Lead-Zinc Smelter }
Lead-Zinc Concentrator } Teeces, Utah

Address: Ore Purchasing Department

International Smelting and Refining Co.

818 Kearns Building
Salt Lake City, Utah

Please establish contact prior to shipment.

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We are proud of our "BUNKER HILL" trade mark. It represents the highest quality of metals produced. We likewise strive to make "BUNKER HILL" known as a symbol of the highest quality in our relations with our employees, with our suppliers of ores and concentrates, with our stockholders and with the general public.

For information regarding ore rates and shipments

Address:

Executive and Sales Office:
The Bunker Hill Building
660 Market Street
San Francisco 4, California

Ore Purchasing Department:
Operations Office
P.O. Box 29
Kellogg, Idaho

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Forged from special alloy steel
for strength and toughness.



**Now for the first time,
a tungsten carbide insert bit,
“drilled to destruction without
the need of resharpening.”
Lower first cost, lower cost
per foot drilled.**

LIDDICOAT TEE CEE BIT

Liddicoat was the pioneer in the development and manufacture of the single-use steel bit. Now, after years of experience and research, there has been developed a tungsten carbide-insert Liddicoat bit that completely revolutionizes the carbide bit.

The new line of Liddicoat TEE CEE bits (patents applied for) are “drilled to destruction without the necessity of re-sharpening.” The design of the bit and inserts is such that even when dulled a reverse taper does not occur. In the conventional multi-use carbide bit, a reverse taper stops drilling. The four-point bit permits fast collaring, fast cutting, and easy removal from the hole. In spite of these many desirable features, this bit is offered at a new low first cost, which provides low cost per foot of hole drilled.

**TAPER SOCKET . . .
NO THREADS . . .
FAST, FIRM ATTACHMENT**



Illustrated is the improved taper and shim drive fit which has been perfected to provide ease of attachment and removal. No threads to strip; longer rod life.

For information contact your Liddicoat Dealer or Western Rock Bit Manufacturing Company.

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NEW THOR SELF-PROPELLED ONE-MAN DRILLCAT

First on-the-job reports prove Drillcat delivers more work, bigger profits, in less time

CHECK THIS PROOF DIRECT FROM THE JOB

PAID FOR ITSELF IN ONE JOB

A net profit of \$15,000 in one week on rock drilling jobs was reported by one contractor—another, equipped with five Thor Drillcats paid for them in three months from extra profits.

SAVES OVER 2½ HOURS SET-UP TIME

You can set a Thor Drillcat in drilling position—ready to go—in 20 to 25 minutes.

FAST WHEN THE GOING IS TOUGHEST

One man on a Drillcat tugged a 600 c.f.m. air compressor $\frac{1}{2}$ mile over rough terrain, drilled five holes and was back in equipment at his starting point in only two hours.



DRILLING DOWN HOLES. Two $7\frac{1}{2}$ h.p. air motors propel this compact (6 ft. 9 in. overall) Thor Drillcat where no other crawler can go. More than enough power to pull its own air supply. Drilling down holes is no chore for Thor's Drillcat. Using the powerful model 105M drifter and chain feed mast, the hydraulic accumulator keeps boom rigid at all times. This means less steel breakage and less wear on chuck parts.



DRILLING TOE HOLES. The Thor Drillcat is completely flexible. The boom and mast are lowered flat to the ground for toe and lifter holes. Twin reversible drive air motors permit easy maneuvering to any position, any angle. (Note position of controls for easy operation.) A "dead man" control for all air valves is standard equipment on the Drillcat.

These exclusive features make Thor model MM-2 Drillcat the most productive rock-drill you can buy! Ask any Thor distributor for a Drillcat demonstration.

- Thor's super-powered 105M drifter rock drill.
- Rugged Thor BW-2 wagon drill mast and air control motor.
- Self-propelled with two $7\frac{1}{2}$ h.p. Eimco air motors, power aplenty to haul itself and air supply.
- Rigid frame, proved in tractor design, no moving or wearing parts, long lasting, low maintenance.
- Aircraft-type accumulator in hydraulic system absorbs shock.
- Simple hand-operated track take-up. No tools required. No track locks required.
- Large flat platform. Ideal for operator when drilling toe holes, good for tool and fuel storage.

VISIT THOR EXHIBIT, ARBA SHOW

Booth 706, Section D, International Amphitheatre
Chicago, January 28 through February 2



THOR POWER TOOL COMPANY

Aurora, Illinois
Branches in all principal cities

United States

Personalities in the News

CLARK L. WILSON, vice president of New Park Mining Company, has been nominated for chairman of the mining, geology and geo-physics division, American Institute of Mining, Metallurgical and Petroleum Engineers, Inc. Nomination to the post is tantamount to election. Mr. Wilson has served the organization as Utah section chairman; Utah delegate, council of section delegates; and national secretary of council of section delegates. He has been with New Park since 1940.



Thomas J. Hubbard has been named to succeed John Allan as superintendent of the Magna plant of Kennecott Copper Corporation's Utah Copper Division. Mr. Hubbard was general master mechanic in the department of mills before his promotion, and from 1937 to 1955 was maintenance and construction engineer at the company's Hurley plant. Mr. Allan has retired after 43 years with the Utah Copper Division. L. C. Jones, chief engineer of the Division, has also retired after 48 years with the company.

James W. Hutchison is the new vice president in charge of reduction at Olin Revere Metals Corporation, with headquarters at Omaha, Ohio. He is the former plant manager of the Reynolds Metals Company's Jones mill reduction plant at Malvern, Arkansas, and prior to that was associated with the Aluminum Corporation of America.

Hearing examiners for the Bureau of Land Management were appointed recently by the Department of the Interior to conduct contest and appeal hearings, in the western United States and Alaska, arising under United States mining, mineral leasing, and public land laws. Seven examiners were named: Graydon E. Holt, Portland, Oregon; Paul A. Shepard, Billings, Montana; John A. Wood, Sacramento, California; Rudolph M. Steiner, Phoenix, Arizona; Paul J. Dunn and John R. Rampton, Jr., Salt Lake City, Utah; and Joseph C. Conrace, Denver, Colorado.

Dr. Zay Jeffries has been appointed director general of the Second World Metallurgical Congress, which will be staged in Chicago November 2 to 8, 1957. Dr. Jeffries is a former president of the American Society for Metals which is sponsoring the world conclave on metals and metal resources of the free world, and a former vice president of the General Electric Company. William H. Eisenman, national secretary of the American Society for Metals, was chosen to be secretary general of the Congress. Assistant to the director general is Kingsley W. Given, professor of speech at Kansas State College, and formerly associated with General Electric. All three appointees held

similar positions during the First World Metallurgical Congress in Detroit in 1951, which was attended by 500 representatives from 33 nations. The second Congress will be held simultaneously with the 39th National Metal Exposition in Chicago.

E. W. Staab has taken over the duties of senior industrial engineer of the Florida department of International Minerals and Chemical Corporation's Phosphate Division. He has been employed in the Central Engineering Division in Chicago since 1954.

Francis J. Myers has been promoted from assistant district manager to the post of district manager at Republic Steel Corporation's Mineville iron ore mines in the Adirondacks. Walter C. Crusberg has been similarly promoted to district manager of the company's Lyon Mountain mines, also in the Adirondacks. William J. Linney, who had been manager of both operations, died recently.

Douglas L. Cudmore is the new assistant supervisor of supplies for Eastern District operations of the Oliver Iron Mining Division, United States Steel Corporation. The company recently promoted four men at the Extaca experimental taconite agglomerating plant to posts as plant foremen of the operating department. These men, who were all formerly supervisory trainee-plant foremen, are Joseph Bozich, Premus Novak, Arthur Peterson, and Arthur Tynney.

John W. Hill, partner in the Worcester Mines, was recently elected to the presidency of the Grand Junction Geological Society in Grand Junction, Colorado. He replaced John X. Combo, attorney for the Atomic Energy Commission. Alfred L. Bush of the Geological Survey was named vice president; and Arnold L. Brokaw, Geological Survey, was appointed to a three year term as government council member.

John S. Wright has succeeded George A. Heaton as mine superintendent of the U. S. Potash Division of United States Borax & Chemical Corporation in Carlsbad, New Mexico. Mr. Heaton is now chief mining engineer for all potash mining activi-

MAX J. KENNARD has been named to the post of chief engineer of the Engineering and Construction Division of Southwestern Engineering Company in Los Angeles. Mr. Kennard was affiliated with the Combined Metals Reduction Company in Salt Lake City for 18 years in a number of engineering and executive capacities. Most recently he served as vice president in charge of sales and development. WESLEY B. DYER, former chief engineer for Southwestern Engineering, will remain with the organization in the capacity of chief consulting engineer.

JAMES K. RICHARDSON is the newly elected president of the New Mexico Mining Association. Now assistant general manager of the Chino Mines Division of Kennecott Copper Corporation in Hurley, New Mexico, Mr. Richardson has been connected with some phase of mining since his graduation from the Missouri School of Mines in 1932. He also has served as manager of the Utah Mining Association, a position he held from 1946 to 1950, when he first joined Kennecott at its Utah Copper Division.



ties. George R. Bowland has been named refinery superintendent to replace R. H. Mills, who is now production superintendent at the refinery. James H. Rasor, former chief clerk at the refinery, was appointed assistant to the refinery superintendent.

Houston Clark, former administrative assistant at Potash Company of America, is now filling the newly created position of general superintendent of the company's Carlsbad, New Mexico and Dumas, Texas operations.

W. J. Ahl has been appointed superintendent of Inland Steel Company's Bristol iron mine in Crystal Falls, Michigan. He was formerly superintendent of Inland's Greenwood mine, Ishpeming, Michigan. R. C. Annear has been named assistant superintendent of the Greenwood mine.

Ted A. Beck has been promoted to general foreman of the acid and sponge iron plants of the new Kennecott LPF plant of the Ray Mines Division, Arizona, of the Kennecott Copper Corporation. He has been an industrial engineer at the company's Hayden plant since October 1955.

Milton Klein has advanced from junior development man to metallurgical engineer for Southwest Potash Corporation. Bert Wyman has stepped up from junior analyst to analyst and Joe Rice succeeds him as junior analyst.

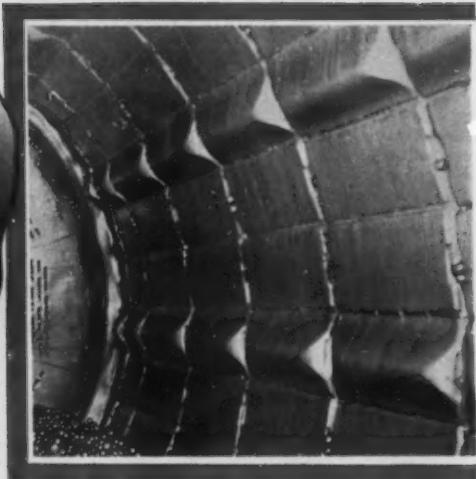
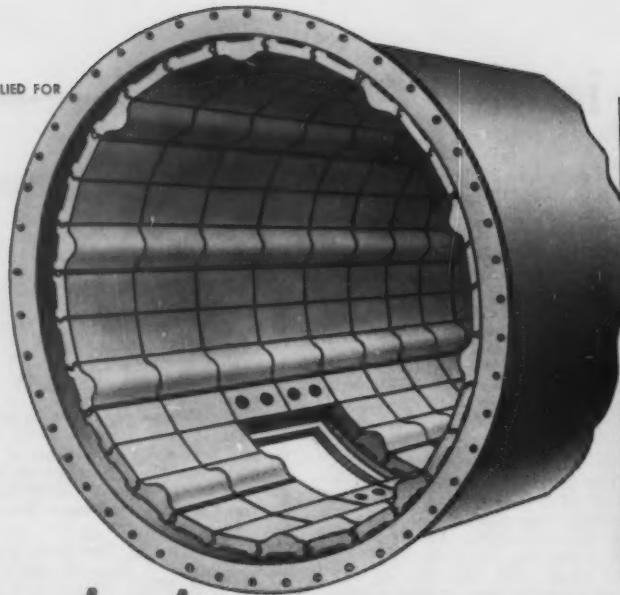
Richard B. Lunn has been appointed superintendent of maintenance for the Mesabi Range mines of Cleveland Cliffs Iron Company.



George A. Lux has been named plant industrial engineer, a newly created post, for the Potash Division of International Minerals and Chemical Corporation, Carlsbad, New Mexico. Mr. Lux was employed in a similar position with the American Viscose Corporation for 10 years.

Dr. S. Allen Lough has been appointed deputy director of the Atomic Energy Commission's health and safety laboratory in New York City. Prior to accepting this appointment, Dr. Lough served as a senior physician for the department of hospitals, New York City, and as instructor of radiology at the college of physicians and surgeons, Columbia University.

PATENT APPLIED FOR



Standardize WITH B&W UNIVERSAL LINER PLATES

SAME CASTING FITS ALL MILL SIZES B&W LINER PLATES RAISE PERFORMANCE, LOWER COSTS

The new B & W Tube Mill Liners have advantages that mean reduced costs in capital, time and labor.

Cost per ton of material ground is reduced, for the practical reasons listed below. Check them—you may find that one, or a combination, of these qualities will solve your existing problems.

- Lower Initial Costs—No pattern and chiller costs—the result of standardization.
- Longer life of liners—Uniform wear will result from better quality control on a mass production casting, utilizing permanent molds. Size is ideal for uniform chill and heat-treatment.
- Longer life for different applications can be realized by a selection of proper materials. This design lends itself to either chilled irons or wear steels.
- Direct labor cost and the "down-time" to install the liners are reduced. Castings are easily handled due to small size and weight. Less fatigue of workers. No cranes needed to handle lightweight liner castings.
- Cost reduced for storage space. Minimum storage space required as small castings "stack" easily.

Records simplified with one design of casting interchangeable for all size mills.

- Saves money on liner inventory. One design fits all diameters of mills, permitting standardization. Quicker unloading and storage possible.
- Savings in breakage claims and delays for replacements. Hard brittle irons are frequently broken in shipment when large castings are used. Small castings are rugged and almost impossible to break by handling.
- Savings in determining most efficient wear pattern. Same castings will produce wear profiles consisting of all lifter ribs, all flats or combination of both, including straight or spiralled lifter pattern.

Liners are supplied in two nominal thicknesses, $1\frac{1}{2}$ " and 3" with $1\frac{1}{2}$ " high lifters. Castings are 6" wide x 12" long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates, write The Babcock & Wilcox Company, Process Equipment Department, Barberton, Ohio.



BOILER
DIVISION

S-464

Newsmakers

in International Mining

Luigi Usoni, director of ore preparation, and Carlo Ciullini, assistant director for the Italian Bureau of Mines, visited mining operations in the United States recently. At Salt Lake City, Utah they viewed research work of the Atomic Energy Commission, Kennecott Copper Corporation's western research center, and the Bingham open pit mine, and Vitro Uranium Corporation's mill. They also visited in Colorado and in the Blind River uranium district of Canada.

United States Atomic Energy Commission offices have been opened in London and Paris. Dr. Amasa S. Bishop of the AEC's research division has been appointed to the Paris post. Dr. Edward L. Brady of Knolls Atomic Power Laboratory, Schenectady, New York, has opened the London office. Commission representatives in these offices will assist in scientific and technical aspects of the expanding work related to the United States program for international cooperation in promotion of peaceful uses of atomic energy.

Raymundo J. Chico has been appointed resident geologist for Four Corners Uranium Corporation's Diamond mine at Gallup, New Mexico. Mr. Chico was formerly with Cerro de Pasco Corporation in Peru and with Dirección General de Ingenieros del Ejercito Argentino.

Julius A. Krug, former United States Secretary of the Interior, was named by the Secretary-General of the United Nations to lead the Technical Assistance Administration team of experts to advise the government of Pakistan on a broad program of flood control and water utilization.

C. J. Sullivan is the new president of Kennco Exploration (Canada) Ltd., Northwestern Explorations Ltd., and Kennarctic Explorations Ltd., the three Canadian subsidiaries of Kennecott Copper Corporation, New York.

A. J. Anderson, president of Kilembe Copper Cobalt Ltd. and Froebisher Ltd., was present at the opening ceremonies of the Kilembe mines in Uganda, East Africa recently. Visitors from Toronto were F. V. C. Hewett, president of McIntyre Porcupine; R. V. Porritt, general manager of Noranda mines; and Lance Rumble. A smelter was opened the same week at Jinja, 250 miles from the mine. Operations at the 1,300-ton mill started last June, but concentrates were stockpiled until the recent completion of the smelter.

Kiguma J. Murata, chemist and member of the Geochemistry and Petrology Branch of the Geological Survey of the United States, was awarded a silver medallion and citation for "distinguished achievement" by the national Japanese American Citizens League. Mr. Murata specializes in the geochemistry of rare earth elements, mineral fluorescence, and spectrographic analysis, and recently completed a research project in cooperation with the National Research Council of Brazil. He joined the Geological Survey in 1931 as a labora-

GEORGE SCHOLEY, general manager of Philex Mining Corporation, which is developing a large low-grade copper mine in Mountain Province, the Philippine Islands, has been in the United States recently buying equipment for the new 1,250-ton-per-day differential flotation mill. Philex recently took over the management of the Benguet Exploration Company. While in the United States Mr. Scholey visited copper operations in Arizona.

tory apprentice and is now leader of the project on general spectrographic methods.

Mr. Steffanson, formerly smelter superintendent for Rhokana Corporation, is now smelter superintendent at Messina, Transvaal, Union of South Africa.

Andrew Robertson, vice president of Eastern Mining and Smelting Corporation, Limited, recently moved his headquarters to 335 Bay Street, Toronto 1, Ontario, Canada.

J. R. Mendius and T. E. Scanlon, mining engineers for the Global Uranium Company of New Mexico, spent several weeks of drilling and prospecting in the Rum Jungle area of Australia.

J. C. Jenkins will leave Mufilira Copper Mines Ltd. of Northern Rhodesia, Africa, to join the staff of the Mount Isa Mines Ltd.'s refinery at Stuart, Australia. R. Neller will replace Mr. Jenkins at Mufilira.

William Strandberg of Anchorage, Alaska was named chairman of the southwestern Alaska section of the American Institute of Mining, Metallurgical and Petroleum Engineers. Mr. Strandberg is associated with Strandberg Mines Inc. and is well-known throughout Alaska for his interest in expanding the Alaskan mining industry. Karl Bachner of Kenai Chrome Corporation was named vice chairman and George R. Schmidt of the Bureau of Land Management was named secretary-treasurer.

Luis A. Nogales, Bolivian mining consultant, is currently employed by the Barium Steel Corporation, of New York, to do mine examination work in Peru and other South American countries.

Paul Schafer, vice president of Philex Mining Corporation, Manila, Philippine Islands, and also a consulting geologist, is in the Celebes Islands of Indonesia examining some copper and nickel deposits for United States capital. When these examinations are finished, he will go to the island of Borneo to examine manganese deposits.

Douglas N. Kendall has been named president of the newly formed Hunting Technical and Exploration Services Limited, of Toronto, Canada. Mr. Kendall is the founder and operating head of the various Hunting companies in Canada. The general man-

ager is W. Harry Godfrey, who has been with the associate company, The Photographic Survey Corporation, since it started in Canada ten years ago. Other directors of the new company are John Henderson, projects administrator; H. S. Scott, technical director; J. B. McClusky, special projects engineer; and D. A. MacDonald. Dr. Norman R. Paterson, a specialist in advanced geophysics, has been appointed chief geophysicist.

Dr. E. L. Evans has been appointed chief geologist for the Canadian exploration activities of the Rio Tinto Group. Dr. Evans will continue in his work as chief geologist for the exploration activities of Technical Mine Consultants Limited, another Rio Tinto company.

H. Reid, former mine superintendent of Lepanto Consolidated Mining Company, has accepted the position of general superintendent of Benguet Ventures Company's Boneg copper property, 30 kilometers north of Baguio City, Mountain Province, the Philippines. He is directing diamond drilling and underground exploration.

R. C. J. Goode has been promoted to a position in the head office of Union Corporation Ltd. in Johannesburg, Union of South Africa, and is succeeded as manager of St. Helena Gold Mines Ltd. by K. A. B. Jackson, previous underground manager.

J. C. St. Smith is general manager of the new Copper Refineries Pty. Ltd., at Townsville, Queensland, Australia, which was formed by Mount Isa Mines, Ltd. He was formerly manager of the Townsville Regional Electricity Board.

W. Ralph Salter is the new president of Beattie-Duquesne Mines, Ltd., succeeding the late C. Glenn Hunter. Mr. Salter is past vice president of Beattie-Duquesne, and is also a director of United Asbestos Corporation, Ltd., Crown Trust Company, and several other Canadian mining companies. Mark Smerchanski will continue as executive vice president of the company.



DR. PAUL DUHOUX, (left) of Brussels, Belgium, and DR. NORMAN R. SCHINDLER have been appointed joint-managing directors of Sogemines Development Company Limited, the wholly-owned subsidiary of Sogemines Limited, of Montreal, Canada. Dr. Schindler will also be manager of the newly formed Exploration Division of Sogemines Development. Since 1951 Dr. Duhoux has been in charge of the mine development programs of the Societe Generale des Minerais, in Brussels, and the exploration interests of Sogemines Limited. For the past three years Dr. Schindler has been chief geologist with Rio Canadian Exploration Limited.

National Gypsum Begins Steady Production From Milford Station Mine in Nova Scotia

National Gypsum (Canada), Ltd. recently began production from its new mine at Milford Station, about 30 miles north of Halifax, Nova Scotia. The first sod was turned at Milford on January 15, 1954. Sixteen months later development of the deposit had been completed and sufficient overburden had been stripped to permit production to begin.

Overburden is being cleared initially from an area 2,000 feet wide and 4,000 feet long and hauled to one of five disposal areas. These areas were selected in places where the overburden is too great to warrant stripping or where the underlying gypsum is of inferior quality. Most of the gypsum lies under less than 40 feet of overburden, sometimes within a few feet of the surface.

Pushloaded by two Allis-Chalmers HD20s, three single engines 15.5-cubic-yards and one "twin" engined 18-cubic-yard Euclid scrapers strip the clay and haul it to one of the disposal areas, up to 5,000 feet away. A recent addition was a new Caterpillar D8 tractor to perform as a multi-task unit, as well as to assist in pushloading when needed. The addition brings the Caterpillar D8 fleet at Milford to six units.

Following the scrapers, a Cat D4 tractor and a Gradall clean up the rough gypsum surface. The D8 and a Cat No. 12 motor grader build and maintain the long haul roads. More than 4,000,000 yards of overburden still have to be stripped.

Gypsum is presently being removed to a floor 10 feet below sea level. This means working faces of about 80 feet in height and in places increasing to over 125 feet. Faces of this latter height will be split for mining. Another 150 feet thickness of gypsum lies beneath this level.

Using three Parmano drills, 6-inch holes are drilled 100 feet into the face on 6- to 7-foot collar centers, tipped down slightly from horizontal to compensate for the slight elevation of the drills above the quarry floor. The holes are charged with 35 and 40 percent CIL Stopite and Forsite, producing about 5 tons of fragmented gypsum for each pound of explosive. When necessary for trimming or to square a corner, 2-inch

holes are drilled vertically on 7-foot squares. Secondary breakage is handled with jackhammers and 1-inch stick powder.

The face is blasted from 150 to 700 feet long, every three to six weeks. Each blast breaks out from 50,000 to 175,000 tons of gypsum. Working at full capacity, the plant and 150 men can produce close to 1,000 tons per hour loaded on railway gondolas for the 30-mile haul to Bedford Basin.

As soon as the dust settles after a large blast, the crew moves in to tackle the broken gypsum. Four 2½-yard Northwest shovels chew into the face, dumping the chunks into a fleet of 22-ton Euclid trucks. The trucks haul to the primary crusher, only 500 feet away. Two Caterpillar D8 tractors assist the shovels, cleaning up the floor and loose rock above the face. One LeTourneau Tournadozer dozes the large chunks to another section of the pit for secondary breakage and does general cleanup work around the quarry. Another Northwest with a 70- to 80-foot boom follows the shovels, swinging its 4-ton ball against the face to scale off loose rock and to help with secondary breakage.

The primary crusher discharge is located 60 feet below the present quarry floor, in the western edge of the pit. A Pennsylvania single roll rock crusher, with a 36 x 72-inch roll, is used for primary crushing.

The gypsum moves up from the primary on a conveyor belt operating in an underground steel and concrete tube, to the secondary crusher building, 800 feet away on the surface.

After passing two, Tyler, double-deck screens, the plus 4-inch gypsum is fed to an Allis-Chalmers 36 x 60-inch single roll Fairmont Secondary crusher. The secondary discharge and the screened finer gypsum rock is stockpiled to the west of the crusher plant. Two Jeffrey magnetic belt loaders, operating in a tunnel under the stockpile, spill the crushed gypsum onto a conveyor which in turn dumps onto a shuttle in the rail car loading station. Here each gondola gets an approximately 80-ton load for the 30-mile haul to Wright's Cove, across the harbor from Halifax. Two trains a day move the

crushed gypsum to Wright's Cove for loading into ships for transfer to other parts of Canada and to the United States.

Option On Bolivian Mine Goes to National Lead

The Mining Corporation of Bolivia, which operates the nationalized mines, has drawn up a contract whereby the United States firm, National Lead Company, will develop the Mathilda zinc mine. The mine belonged to the Mauricio Hochschild group before its nationalization.

National Lead will have a maximum term of six months to sign the contract. During this time the company is authorized to send any technicians, engineers, and laborers of their choice to the property to study mining potentials; and is given the right to choose a convenient location for its central offices and there to set up any machinery and equipment necessary for examination of mineral resources.

If National Lead should decide to abandon examination activities and not sign the proposed contract, the only obligation would be to pay the workers' wages in accordance with general labor regulations, and turn over the materials and equipment used to the Bolivian Union.

Under the 25-year contract a 1,000-ton-per-day capacity concentrator would be constructed, head offices established at La Paz, and royalties paid to the Bolivian government according to a staggered plan. National Lead would have the right to import machinery and working equipment tax-free for a certain period of time, and would be free of tax on exports of mineral ore. The company would also be able to contract for technicians it decides are necessary to carry out the work.

The Mathilda mine is actually a collection of various mining enterprises and accessory plants in the districts of Timusi, Ancoraimes, and Carabuco. Abundant deposits of zinc, lead, copper, silver, and gold are found in this area.

Federal Agrees To Expand Conjecture Operations

Operation of the Conjecture silver-lead mine in the Lakeview mining district of Bonner County, Idaho has been taken over by the Federal Uranium Corporation of Salt Lake City, Utah under an agreement with Conjecture Mines, Inc. of Spokane. Federal will spend \$200,000 in converting a 1½-compartment shaft to two compartments, deepening the shaft from the 500-foot level to the 700, and drifting 600 feet on the vein at the deeper horizon.

Upon completion of the first stage, Federal can acquire a half interest in Conjecture ore by putting up additional finances needed to enlarge the present 50-ton mill and to carry on mining operations. Federal expects its initial expenditure to enable it to meet a minimum production goal of 300 tons of ore daily.

Donald E. Majer of Spokane is president of Conjecture Mines, while Ralph W. Neyman is president and general manager of Federal. A 25-man crew will work around-the-clock six days a week under the direction of Walter Campbell, superintendent.



Blasted gypsum is dumped into bin at quarry floor level (foreground) for 65-foot drop.

Philex Mining Planning Major Copper Mill In Mountain Province of Philippine Islands

Philex Mining Corporation is starting construction of the first unit of a 5,000-daily-ton copper-gold flotation mill to treat ore from the Santo Tomas group of mines 16 kilometers south of Baguio, Mountain Province, Philippine Islands. The initial unit will have a capacity of 1,250 daily tons and will treat ore from three different mines. (Attached map shows location of mines, mill site, etc.)

Philex was organized in July 1955 by Henry Primo, president; Paul Schaefer, vice president; and George Scholey, general manager. All have many years of mining experience in the Philippines. First work on an aggressive exploration and development program was started on the mineralized area south of Baguio where options had been obtained on three groups of mining claims.

The three projects were designated Santo Tomas I, Santo Tomas II, and Santo Tomas IV. Santo Tomas I contains a narrow vein, averaging 3 to 20 feet in width assaying 3.0 percent copper and 0.04 ounce gold per ton. Santo Tomas IV contains predominately gold values with the vein averaging from 2 to 6 feet in width and assays 0.25 ounce gold and 0.50 percent copper per ton.

Santo Tomas II is a large low-grade project; to date 20,000,000 tons of ore have been blocked out averaging 0.94 percent copper, 0.03 ounce gold, and a small amount of cobalt per ton. The ore body at No. II has an average width of 400 feet and has been drilled to a vertical depth of 600 feet with good values still in the bottom. The length of the ore body has not been determined, as yet, because the western extension goes into an area covered by the Philippine Central Cordillera Forest Reserve and exploration work was stopped at the boundary. Assays were averaging around 1.3 percent copper over a width of 360 feet at the boundary. The ore body has been developed by 9,000 feet of diamond drill holes, and 1,530 feet of crosscuts and drifts. The blocked out area covers a width of 400 feet, length of 1,000 feet, and a depth of 600 feet. Ore in this area is estimated as follows:

Area	Short Tons	Percent Copper	Ounce Gold Per Ton
A	800,000	1.30	0.04
B	4,200,000	1.10	0.04
C	15,000,000	0.88	0.02
<hr/>		20,000,000	0.943 (Average)

This ore body has been developed along a diorite-andesite contact with sulphides forming veinlets filling fractures. Chalcopyrite is the chief copper mineral. There is also a small amount of pyrite.

The mill will be centrally located and will treat ore from the three projects. Plans call for 150 tons per day from Project I, 1,000 tons per day from Project II, and 100 tons per day from Project IV. Ore from Projects I and IV will be brought to the mill over an aerial tram 4.0 kilometers in length. The one tram will serve both projects. Ore from Project II will be brought to mill site by aerial tram, at first, and later by means of a long tunnel. The mill site is approximately 1,500 feet lower than the No. II project and 3.0 kilometers away.

Mining at the No. II project will be done by glory holing, at first, and later by block caving. By driving a 2,600-foot cross cut, a depth of 600 feet can be obtained below the outcrop of the ore body. There is only a very small amount of overburden and it is planned to drive this cross cut and then to raise to the surface with two ore passes. Ore at first will be shovelled into these ore passes by bulldozers.

While the surface ore is being mined by glory holing and benching, the block caving system will be laid out and when the approximate 500,000 tons of surface ore are mined, drawing will be started from the block caving system.

The mill is being laid out so that additional units can be added later on. The first unit will treat ore averaging 1.3 percent copper from the No. II project. As the mill capacity is increased, the grade of the ore will be lowered.

Plans had called for the starting of construction of the mill in April 1956 but there was a delay due to the failure of the Philippine Senate to allow the release of the mineralized area falling within the Forest Reservation. At that time it appeared that the release of the area for mining would be a simple matter of routine but this idea proved wrong and the long delay in mill construction ensued. It has been decided by the Philex board

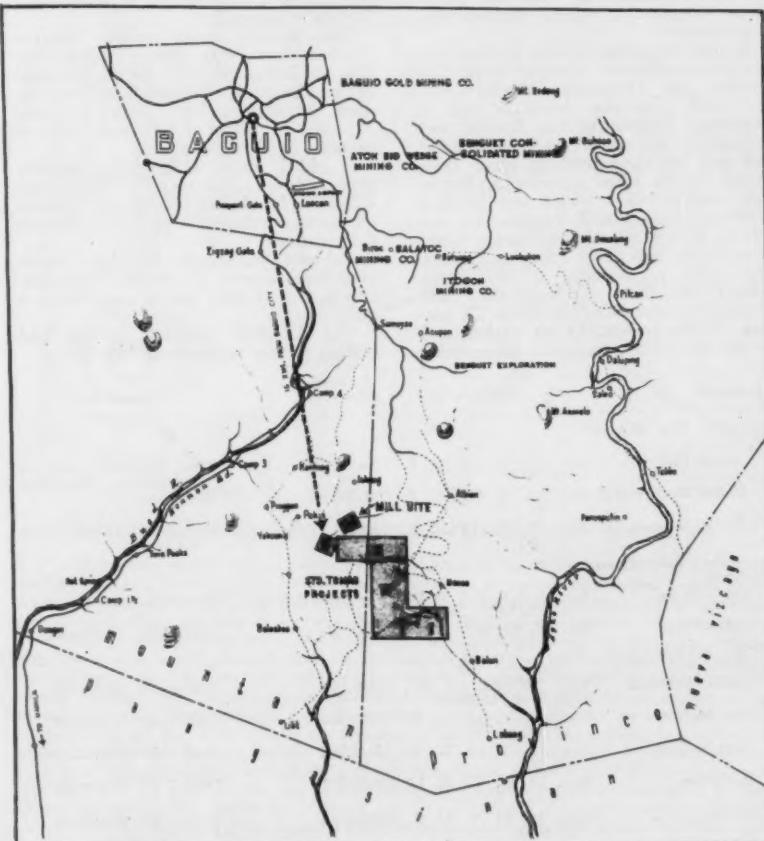
to go ahead with mill construction plans because there already are above 20,000,000 tons of ore blocked out in an area free from the Forest Reservation.

Exploration and development of the No. II ore body was one of the fastest executed mining programs ever carried out in the Philippines. An option was obtained on the area in October of 1955 and a diamond drilling program using two drills was started immediately. By the end of March 15,000,000 tons of ore had been indicated, and by the end of June, when the drilling program was stopped, the reserves stood at 20,000,000 tons as listed above.

The exploration and development of this area was quite difficult. The ore body lies at an elevation of 5,000 feet above sea level and in very rugged terrain. All equipment and supplies had to be carried in by cargadores (men) a distance of 10 miles. This made the work rather expensive. For instance, it cost as much to carry in five gallons of gasoline as the initial purchase cost.

Ore will be concentrated by means of flotation and the concentrate exported to either Japan or the United States. About 0.01 ounce per ton of the gold occurs free and will be recovered in the grinding circuit by means of jigs. The first primary grinding unit will be a 10- by 10%-foot ball mill, one of the largest installed in the Orient.

I. O. Hidalgo is general superintendent of the Santo Tomas project. George A. Scholey is in charge of the lay out of the block caving system.



UNITED STATES NEWS

Nuclear Research Center Completed at Battelle

The nation's first privately owned nuclear research center was completed recently at Battelle Institute in Columbus, Ohio with the addition of a 1,000,000-watt research reactor, costing \$750,000.

The largest of the "pool type" yet to be put in service in the United States, the reactor was designed for research purposes exclusively. It uses solid uranium-235 fuel, and the core—composed of fuel elements and boron control rods—is suspended 22 feet below the surface in a large pool of highly purified water. The water serves as the coolant and as a shield to protect personnel from the radiations. It was designed by Battelle physicists and was engineered and built by the American Machine and Foundry Company. The Institute expects to keep it operating 24 hours a day, six days a week.

The reactor will be used in research on the chemistry of petroleum, sterilization of pharmaceutical products, preservation of agricultural goods, and improvement

and development of numerous chemical, glass, plastic, ceramic, and metallic products and processes.

The nuclear research center, built entirely with Battelle funds, is free to contract with private industry for nuclear research without government security restrictions. However, the center's technologists are directed to maintain industrial confidences and, when applicable, to observe government security regulations.

Within the last 13 months the Institute has completed radiation laboratories and a laboratory for reactor development. Battelle also has had ore treatment and chemical engineering laboratories for the recovery of fissionable materials, a reactor materials laboratory, and radiochemical facilities. (See MINING WORLD, November 1955, page 81).

Union Carbide Purchases Trace Elements Company

Union Carbide Nuclear recently purchased the uranium properties of Trace Elements Corporation of Grand Junction, Colorado by an exchange of Union Car-

bide and Trace Elements stock. This creates a Trace Elements subsidiary of Union Carbide Nuclear, which is the atomic subsidiary of Union Carbide & Carbon Corporation.

A contract was recently signed between Trace Elements and The Atomic Energy Commission to build and operate a mill at Maybell, Colorado. The contract will be assumed by Union Carbide Nuclear.

Most of Trace Elements' properties are located in northwestern Colorado, with a few in Utah and Wyoming.

Cincinnati Plant Tests New Hafnium Process

An exclusive option on a process for separating hafnium from zirconium chloride has been obtained by the United States Industrial Chemicals Company, a division of National Distillers Products Corporation. The process was developed by the Commonwealth Scientific and Industrial Research Organization of Australia.

Hafnium is closely associated with zirconium and renders zirconium metal unsatisfactory for use in construction of some atomic reactors. The process is being tested for its commercial practicality in U.S. Industrial Chemical's pilot plant in Cincinnati. It greatly reduces the cost of separating hafnium from zirconium because it eliminates a series of chemical steps which are now used in commercial production.

If the process is commercially feasible U. S. Industrial Chemicals will buy world-wide patent rights which exclude only Australia. The company is building a 2,000,000-pounds-per-year plant in Ashtabula, Ohio for the production of reactor grade zirconium sponge, which will initially use the conventional separation method and later switch to the new process. The plant will be ready for operation in July 1957.



Kermac and Homestake Dominate Ambrosia Lake

Who will mine and mill Ambrosia Lake uranium ore has been an intriguing question for the mining industry for the last several months—particularly so, after American Metal Company, Ltd. pulled out of its negotiations with the Sabre-Pinon Corporation which controls very large reserves.

In mid-December it was obvious that two groups—Kermac Nuclear Fuels Corporation and Homestake Mining Company—will play the dominant role in Ambrosia. Homestake has formed two partnership agreements to finance, mine, and mill ore developed by other companies. In its latest agreement, Homestake will develop mines and build a 1,500-ton-per-day mill (negotiations underway with U. S. Atomic Energy Commission) on the Sabre-Pinon properties. The new partnership is Homestake Sabre-Pinon Partners; Homestake will manage the operation and retain 25 percent of the profits. In an earlier and somewhat similar agreement, Homestake,

Rio de Oro Uranium Mines, Inc., United Western Minerals Company, J. H. Whitney and Company, White Weld and Company, and San Jacinto Petroleum Company formed Homestake-New Mexico Partners. This group is planning a 750-daily-ton mill.

The second major group, Kermac Nuclear Fuels, was formed by Kerr McGee Oil Industries, Inc., Pacific Uranium Mines Company, and Anderson Development Corporation. A mill with a proposed capacity of about 1,500 daily tons is planned by this group.

A third major mill, daily capacity projected at 1,500 tons, is under consideration by Phillips Petroleum Company on leases purchased from Holly Minerals Corporation.

Calumet and Hecla, Inc. has discovered large deposit in extreme southeastern part of district and is considering a mill.

The Ambrosia uranium mining and milling picture today looks like this:

Company	Location	Inferred Reserves	Remarks
Homestake New Mexico Partners			
Rio de Oro	Sec. 11, T. 14 N., R. 750,000 tons 10 W.		First Ambrosia mine in production. Westwater
United Western et al	Sec. 32, T. 14 N., R. 500,000 tons 9 W.		
United Western	Sec. 36, T. 14 N., R. Small 10 W.		Shaft bids solicited Poison Canyon
Homestake Sabre-Pinon Partners			
Sabre-Pinon	Secs. 1, 2, 3, 5, 7, 9, 17, 21, T. 14 N., R. 9 W.	Very little drilling	Westwater
Sabre-Pinon	Sec. 15, 23, 25	8,000,000	Drilled out Westwater
Kermac Nuclear Fuels Corporation			
Pacific Uranium	Secs. 10, 24, 26, 27, 3,500,000 T. 14 N., R. 10 W.		Drilled out Westwater
Kerr McGee	Sec. 22, T. 14 N., R. 5,000,000 10 W.		Drilled out Westwater
Kerr McGee	Sec. 10, T. 14 N., R. 500,000 10 W.		Shaft sinking Westwater
Anderson	Secs. 18, 20, 30, T. 14 N., R. 3,000,000 9 W.		Drilled out Westwater
Phillips Petroleum	Secs. 28, 34, T. 14 N., 3,000,000 R. 9 W.		Drilled out Westwater
Calumet and Hecla	Sec. 23, T. 13 N., R. 1,000,000 plus 9 W.		Partially drilled Poison Canyon

Tungsten Mining Corporation of Henderson, North Carolina, owned about 70 percent by Haile Mines Inc. and 30 percent by General Electric Corporation, showed production increases in the past fiscal year ended August 31, 1956. Total production for that period was 165,393 units as compared with 155,133 units for the fiscal year ended 1955. While the 1956 output was the highest in the company's history, revenue declined from \$9,773,000 for the 1955 fiscal year to \$9,582,000 for 1956 because of the termination of the Domestic Tungsten Program on June 1, 1956. Tungsten Mining mined and milled 333,000 tons of ore during the past fiscal year. Current development increased reserves by 577,000 tons which at August 31, 1956 amounted to 1,453,000 tons, an all-time high.

Barter contracts for supplemental-type strategic materials signed in September 1956 had a total value of \$19,400,000, according to the Department of Agriculture. In the previous August these contracts had totaled \$28,000,000. During

the fiscal year 1956, contracts signed totaled \$104,900,000 in supplemental-type strategic supplies. Supplemental-type strategic materials contracted for in September 1956 included: abrasives, crude aluminum oxide, \$6,300,000; lead, \$5,500,000; zinc, \$4,700,000; cadmium, \$1,500,000; quartz crystals, \$1,200,000; and mica, \$200,000. Under the Department's barter program, Commodity Credit Corporation-owned farm commodities are offered in exchange for strategic materials for the national stockpile and for the supplemental stockpile, which are stockpiled for national defense, and for non-strategic materials for transfer to other government agencies.

The U. S. Bureau of Mines has openings at Rolla, Missouri for research metallurgists and mining engineers. Entrance salaries range from \$4,480 to \$8,990 per year. Additional information can be obtained from R. W. Geehan, U. S. Bureau of Mines, Box 136, Rolla, Missouri.



M. A. Hanna Company will erect a new surface plant and sink a new shaft in the Minerals Hill area of Michigan. This work is not to open up a new property, but upon completion will be a joint plant serving both the Homer and Wauseca mines, replacing existing facilities which will become inadequate as mining goes to greater depth. The new shaft will be located on the Minskler farm property. It will be sunk to a depth of more than 2,000 feet; it will be circular, 20 feet in diameter with a full concrete lining, the first of its kind in the Lake Superior district. Walsh Construction Company of New York is doing the work. The plant at the new site will include the usual office, change house, and shops. Missing, however, will be the engine or hoist house, since it is planned to use friction-type hoists mounted in the headframe, rather than the conventional ground-mounted drum hoists which until recently had been standard throughout the industry. Temporary facilities are already under construction and it is expected that production through the new shaft will start in 1960.

As of December 5, iron ore shipments on the Great Lakes had totalled 76,575,710 gross tons, or 10,792,971 tons below the total at the same time last year. Because of the strikes this season, the yearly total is expected to be about 10,000,000 below last year's figure of 87,500,000 tons. Although most of the fleet has been berthed for the winter by the end of the first week in December, Pittsburgh Steamship division of U.S. Steel Corporation had obtained approval from the U.S. Army Corps of Engineers for an extension to January 1 for the closing date of the vessel locks at Sault Ste. Marie. Oliver Mining Division of U.S. Steel has been shipping small tonnages by the costly all-rail route from Minnesota to Chicago to safeguard against shortages.

Bechtel Corporation of San Francisco, California has received the contract for engineering and design studies on an iron ore concentrating plant for Hanna

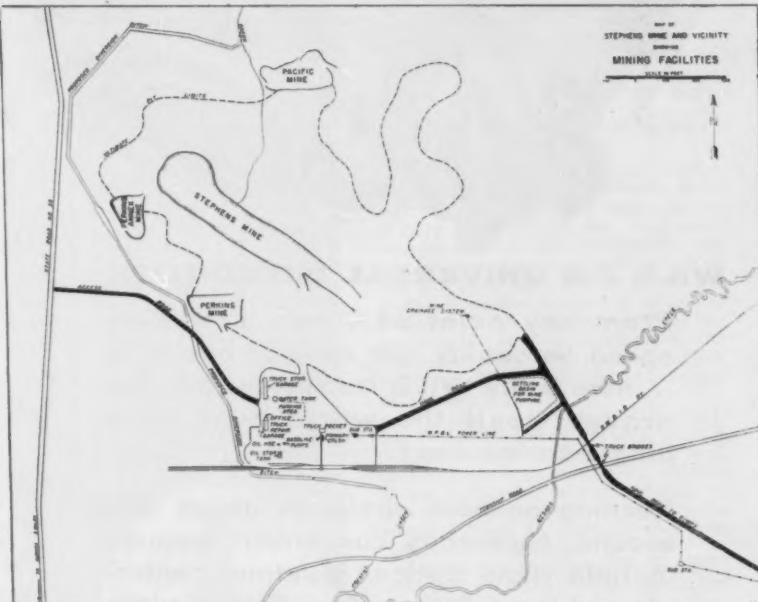
Coal and Ore Corporation of Cleveland, Ohio. Hanna is interested in determining the feasibility of opening the Groveland property near Iron Mountain, Michigan. (See MINING WORLD, December 1956, page 96.)

The 1,000,000-ton of iron ore was mined at Pickands Mather & Co.'s Fortune Lake mine near Crystal Falls, Michigan, on September 19, 1956. Stripping was started at this mine in the fall of 1951 by the Crystal Falls Corporation which is now in charge of ore loading operations. The overburden averaged 90 feet in depth. Mining started in 1953.



Painted Desert Uranium and Oil Company of Spokane, Washington has leased a 260-acre property in Arizona's Navajo Indian Reservation which was partially drilled by the U.S. Atomic Energy Commission. W. M. Fredericks is secretary.

Mining and milling operations at the Purple Pansy manganese mine, recently acquired by the Ambrosia Mining Company of Albuquerque, New Mexico, are being conducted under the name of Herald Mining Corporation of Aguila, Arizona. The new operators have done considerable drilling at the mine and now estimate the developed ore body at 900,000 tons of 8 percent grade. At the mill, both coarse and secondary crushing are employed to obtain a product through $\frac{3}{8}$ -inch mesh which goes to a Wemco sink-float unit. This unit is said to produce a satisfactory concentrate of better than 40 percent. Fines are separated from the sink-float tails and sent to tables for further treatment. These concentrates at present are being stored for further treatment. The mill has a daily capacity of 600 tons of crude ore, and the company is planning to install another sink-float unit and additional tables to increase the capacity to 1,200 tons of crude ore per day. The ore is hauled by truck from the Purple Pansy mine, a distance of four miles, and concentrates are trucked to Aguila for rail shipment, a distance of 11 miles. Officials of the Herald Mining Corporation at Aguila include Neil Rice, mining engineer; Ted Biddle, metallurgist; and John Wite, mill superintendent.



Oliver Opens Mesabi's Largest Iron Reserve

A 47,000,000-ton reserve of iron ore is being reopened by the Oliver Iron Mining Division of the United States Steel Corporation, three miles northeast of Aurora, Minnesota. Known as the Stephens mine, this property has not been operated since 1905. At that time, Oliver had mined approximately 500,000 tons of ore from the deposit. Since its deactivation, the property has been held in reserve to conserve the company's direct shipping ores. This has been possible only because successful research and experimentation by Oliver on low-grade wash ores on the western end of the Mesabi enabled the company to process sufficient low grade to meet market demand. The Stephens deposit differs from most of the Mesabi Range deposit in that the ore lies in a broad shallow bed. Overburden is 20 to 35 feet thick and the ore deposit is only 70 to 80 feet thick. One of the jobs facing the division at the moment is the diversion of a stream flowing through the old Stephens pit. The diversion ditch will be about two miles long and will require the removal of 100,000 cubic yards of material. Proposed location of this ditch may be seen on the map above, along with location of other facilities to be completed by summer. The Duluth Missabe and Iron Range Railway is presently building 11 miles of track to provide storage and haulage track to the present main line. Also under construction is about 10,000 feet of power transmission line by Minnesota Power and Light, a truck pocket, shipping pockets, crushing and screening plant, conveying equipment, truck and tractor repair garages, offices, water supply, and a sewage disposal system.

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A deposit of nickel and cobalt ore has been reported in the Imperial Valley, about 100 miles east of San Diego. The discovery was made by Ross and Minnie O'Callaghan and their son, Lloyd; George N. Graham and Edward Tilmont Roark share in the profits. Purchase of the 150 mining claims has been made by *Industrial Nickel Corporation of America* of Los Angeles, a subsidiary of *Lipko Companies*. Reportedly the firm will pay \$1,000,000 for 40 claims and right to buy 40 additional claims at \$25,000 per claim.

Robert Jacklin of Tutteltown, California has leased the *Mountain Boy* vein in *Mountain Lily* mine on Five Mile Creek, five miles northeast of Columbia, Tuolumne County, California. He is developing a gravel placer channel through a quartz mine.

Wilson Call and Darl Ritter, owners of eight claims known as the *Knob Hill* claims 1 through 8, have sold the property to Garth W. Thornburg. Mr. Thornburg is also associated with *Lakeview Mining Company*, *Gunnison Mining Company*, and other uranium producers on the Colorado Plateau. The Knob Hill claims are on a 160-acre tract at the base of Castle Buttes, 10 miles northeast of Mojave, California. Sale price is said to be \$200,000, payable as follows: \$7,000 cash and 15 percent of the gross revenue until \$200,000 is paid. Terms of the sale also reportedly include completion of 3,000 feet of drill holes before spring which will cost Mr. Thornburg an additional \$20,000.

Kern Uranium Company reports a uranium strike in surface pitting operations on its property in the Kern River Canyon of California. The ore is believed to be either uraninite or pitchblende. The site of the strike is on the bank of the river between the *Miracle* mine and the *Kergon* mine.



Production from *Consolidated Eureka Mining Company's* lead-gold property at Eureka, Nevada is reportedly averaging about 500 tons monthly of dry ore.

A discovery of a large vein carrying silver was made in the old *Betty O'Neal* mine, 13 miles south of Battle Mountain, Nevada by the *Red Rose Mining Company*. The discovery was made in the No. 5 tunnel in the continuation of the *Betty O'Neal* vein, about 800 feet from the opening of the long tunnel which was driven by the original *Betty O'Neal Mines Company* in the 1920's. The *Battle Mountain Bank and Mortgage Company* which now owns the property, gave M. S. Fisher a lease and bond. He, in turn, assigned his interest to the *Red Rose* firm on a share basis.

Argentum Mining Company of Mina, Nevada has enlarged its 100-ton-per-day gravity-flotation mill to a 500- to 600-

ton-per-day operation. The plant, located at Columbus Marsh, treats ore from the *Northern Belle*, *Mt. Diablo*, and *Holmes* silver mines near Candelaria.

Metallurgical Development Company has resumed operation of its tungsten mill in the Pinenut Mountains near Gardnerville, Nevada. The mill treats ore from the company's own nearby mine, and also does custom work for three other mines in the district: *Val-Pine* mine operated by Clyde Morrison and Sons; the *Alpine* mine operated by Claude Lovestedt; and a property in Hope Valley operated by George Brewer.



National Potash Company's two shafts are now down to the ore zone, and the 21-mile water pipeline has been completed. The plant is expected to go into production next month. This company was formed by *Freeport Sulphur Company* and *Pittsburgh Consolidation Coal Company* to mine potash from the Carlsbad, New Mexico area. The \$19,000,000 project will have an annual capacity of 40,000 tons of muriate containing 60 percent K₂O.

Rio de Oro Uranium Mines, Inc. has purchased 1,460 acres of land in the Ambrosia Lake area of New Mexico from *Columex Uranium Corporation*, which retained 12½ percent overriding royalty.

Kermac Nuclear Fuels, Inc. has broken ground for a 550-foot shaft in the Ambrosia Lake district, and plans for a second shaft are under consideration. *St. Anthony Uranium Company* is sinking a 295-foot shaft north of Laguna, near the *Jackpile* mine. *Farris Mines Company* is reactivating the *Dakota* mine eight miles northeast of Prewitt in the Haystack district. *Holly Minerals* is sinking its third shaft in the Ambrosia Lake district.



Lone Star Mercury Inc. reports discovery of a cinnabar ore extension of the *Louisa* mine in the Terlingua district, southern Brewster County, Texas. The ore is said to assay 45 pounds of mercury to the ton, compared to a previous high from other company mines of 20 to 25 pounds. Lone Star expects to produce from 40 to 50 flasks of mercury per week, and is completing installation of a new furnace.

Two proposals were submitted in reply to the *Federal Facilities Corporation's* call for bids on the tin smelter at Texas City, Texas. *Wah Chang Corporation* of New York and Ellis E. Patterson and S. Fishfader of Los Angeles were the two bidders for purchase of the plant. The Patterson-Fishfader proposal was filed on behalf of a group of interested parties. No lease proposals were received. No decision had been made at this writing.



Thunderbird Development of Craig, Colorado has made its first preliminary shipments of uranium ore from newly developed ore body in the Axial Basin area of Moffat County, Colorado. Ore was sent to the Carbide Nuclear mill at Rifle.

Camp Bird Ltd. plans to open up a number of veins in its Ouray County, Colorado properties and has already started a diamond drilling program. The firm hopes to be in a position to consider

installation of a new 500-ton-per-day mill before the end of 1957 with production estimated to begin in 1958. Camp Bird's properties have been under lease to *King Lease, Inc.* for a number of years. This lease was recently terminated by Camp Bird who will develop the property itself.

Idarado Mining Company has closed the Red Mountain mill, crushing plant, and assay office at Treasury Tunnel, Colorado. All underground lead and zinc ore is now being transported to the Telluride side and processed in the company's Pandora mill. The Red Mountain and the Pandora mills are separated on the surface by the San Juan Mountain Range, but these operations are connected underground. It was decided that

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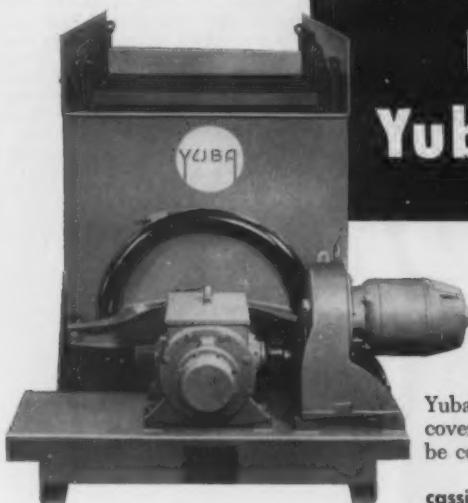
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ROCKY MOUNTAIN

it was better to keep one mill in full operation, than two mills at partial capacity.

Climax Molybdenum Company hopes to place its No. 17 ball mill in operation on February 25, 1957. The *J. A. Park Machinery Company* of Pueblo, Colorado has been the construction contractor, and Whitney Elliott is construction superintendent in charge of the contractor's force. Planning and designing of the mill were done by the *Climax* staff. The new unit is being constructed adjacent to operating units within the No. 3 and 4 mill building. It will be a replica of the No. 10, a 13-foot by 12-foot Allis Chalmers. It will have a capacity of about 150 tons of ore per hour, and will be driven by a 1,000-horsepower General Electric motor. The unit was not designed to increase mill capacity but to assist in the recovery of molybdenum. It is estimated that the new unit will increase recovery by three to five percent.

Mining has started at the *Union Oil Company of California's* huge \$5,000,000 shale project in Parachute Creek Canyon, 11 miles north of Grand Junction, Colorado. Shale is being removed from the open pit 1,000 feet above the valley floor and hauled to a primary crusher a short distance away. It is taken down the mountainside to the secondary crusher by aerial tram. From here it passes to a screening tower where the fines are removed before the shale is stockpiled for retorting. The retort, to have a capacity of more than 300 tons per day, will be completed soon.

NORTH DAKOTA



The Federal District Court at Bismarck, North Dakota, ruled recently that mineral leases held by *Stanolind Oil Company* and the *Ohio Company* on about 2,000 acres owned by the *Evangelical Lutheran Church* in Billings County, take precedence over a later lease issued to *Manidon Mining Company* of Mandan and Amidon, North Dakota, for uranium prospecting. The court held, in a "quiet title" action instituted by the church, that the title be quieted in favor of the church, subject to leaseholds of the two oil firms. Ten-year leases were taken by the firms in 1953 and two years later the church executed a lease for uranium development to Manidon. The church contended the first lease applied to oil, gas, and related fluid hydrocarbons. This is believed to be the first case of its kind to be decided in the U.S., and affects many area leases. Manidon plans an appeal.

UTAH



Development work at the *Ransom* uranium mine near Blanding, Utah is being pushed by *Sunshine Mining Company*, north Idaho silver producer, which took over the operation recently. Preliminary

ROCKY MOUNTAIN

drilling of the principal ore body has been completed. E. E. Eddy, formerly of the firm's Spokane, Washington exploration division office, is mining engineer in charge.

Centennial Development Company has been selected as contractor for sinking of a 1,020-foot prospect shaft in the East Tintic lead-silver-zinc district of Utah. The project is part of *Bear Creek Mining Company's* plans for exploration of this district with consent of the major companies in the area. With completion of the shaft, Bear Creek will then drill, drift, and crosscut from the shaft. Three separate mineralized areas have already been reported in core and churn drilling from the surface. Bear Creek is the exploration subsidiary of *Kennecott Copper Corporation*.



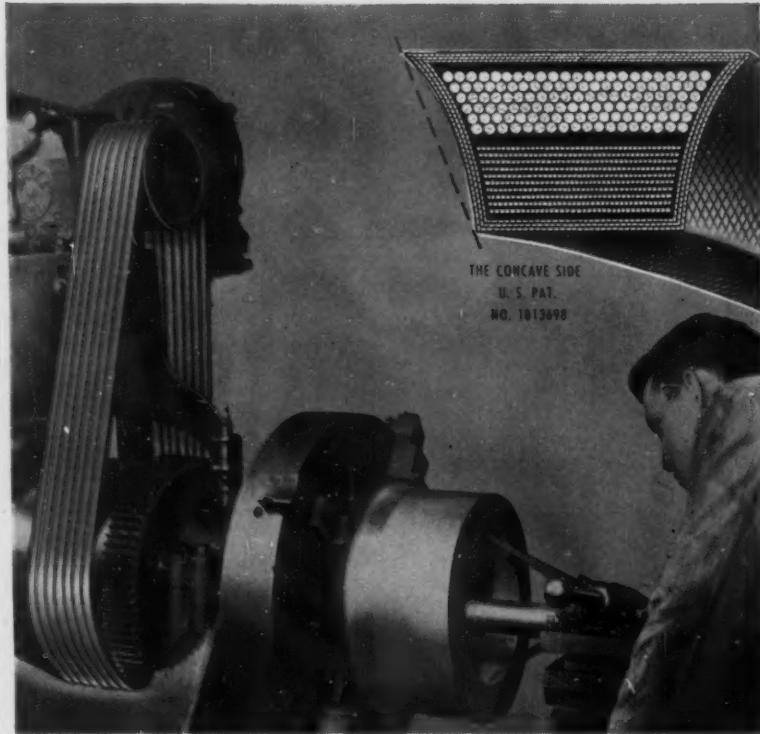
Biggest development in finding large new uranium reserves in the United States is the successful follow-up of recent discoveries in several areas of Wyoming and Montana, where excellent ore, usually tyuyamunite, is found in Madison limestone of Mississippian age. These ancient rocks of the Big Horn Basin, Hanna Basin, and other huge structural features had been written off as hopeless by earlier investigators, who thought Wyoming's commercial uranium would be found only in relatively recent Tertiary deposits, as at Pumpkin Buttes, Gas Hills, Crooks Gap, and Baggs areas.

A \$750,000 plant to upgrade phosphate ore from Wyoming and Utah mines is being constructed by *San Francisco Chemical Company* at Leefe, 25 miles west of Kemmerer. D. L. King, president and general manager, said the plant will have a daily capacity of 1,000 tons when it is completed in about six months. The plant will utilize a new hydrometallurgical process developed by research at the *Colorado School of Mines Foundation*. Mr. King said the new plant is expected to open an entirely new approach to upgrading of western phosphate deposits.

Drilling crews of *Lost Creek Oil & Uranium* have closed down operations for the winter in the test drilling program on the *Lamac* and *Frazer* claims in the Gas Hills. Lost Creek entered into a drilling and mining contract with *Great Northern Uranium Corporation* on the claims. A good-sized body of ore, from two to 20 feet in thickness, is reported partially blocked out.

Several hundred tons of good grade uranium are being mined monthly by *Gas Hills Uranium Company* at its mine on the *Sagebrush No. 1* claim in the Puddle Springs section of the Gas Hills area, Wyoming. The mine is the first in the Gas Hills conceived from the beginning as an underground operation, mining some 65 feet below the surface. Roy Noble, general superintendent, says that because of dirt and dust in summer and extreme cold in winter an open-pit operation would be more expensive than underground. The mining is currently being done in a bed 30 feet thick.

The president of *Loma Uranium Corporation*, Carl Lough, has announced his firm is investigating construction of a uranium mill in Converse County, Wy-



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Fig. 1



Fig. 1-A



Each sidewall of a Gates V-belt is concave (Fig. 1) — a precisely engineered curve that makes V-belts last far longer.

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Bend a straight-sided belt (Fig. 2). The sides bulge at the bend causing uneven contact in the sheave groove (Fig. 2-A). Naturally, wear is greater at points indicated by arrows. Result: shorter belt life, increased belt costs.

Fig. 2



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1½"	45	70	92	103	117	123	135	145	155	165	175	185	195	205	215	225	235
2"	100	160	210	240	260	280	300	320	340	360	380	400	420	440	460	480	500
2½"	210	350	460	500	540	580	620	660	700	740	780	820	860	900	940	980	1020
3"	310	570	740	800	860	920	980	1,040	1,100	1,160	1,220	1,280	1,340	1,400	1,460	1,520	1,580
3½"	410	700	950	1,050	1,150	1,250	1,350	1,450	1,550	1,650	1,750	1,850	1,950	2,050	2,150	2,250	2,350
4"	510	800	1,050	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500
4½"	560	850	1,100	1,250	1,350	1,450	1,550	1,650	1,750	1,850	1,950	2,050	2,150	2,250	2,350	2,450	2,550
5"	660	950	1,200	1,350	1,450	1,550	1,650	1,750	1,850	1,950	2,050	2,150	2,250	2,350	2,450	2,550	2,650
5½"	710	1,000	1,250	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700
6"	760	1,050	1,300	1,450	1,550	1,650	1,750	1,850	1,950	2,050	2,150	2,250	2,350	2,450	2,550	2,650	2,750
6½"	810	1,100	1,350	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800
7"	860	1,150	1,400	1,550	1,650	1,750	1,850	1,950	2,050	2,150	2,250	2,350	2,450	2,550	2,650	2,750	2,850
7½"	910	1,200	1,450	1,600	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800	2,900
8"	960	1,250	1,500	1,650	1,750	1,850	1,950	2,050	2,150	2,250	2,350	2,450	2,550	2,650	2,750	2,850	2,950
8½"	1,010	1,300	1,550	1,700	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800	2,900	3,000
9"	1,060	1,350	1,600	1,750	1,850	1,950	2,050	2,150	2,250	2,350	2,450	2,550	2,650	2,750	2,850	2,950	3,050
9½"	1,110	1,400	1,650	1,800	1,900	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800	2,900	3,000	3,100
10"	1,160	1,450	1,700	1,850	1,950	2,050	2,150	2,250	2,350	2,450	2,550	2,650	2,750	2,850	2,950	3,050	3,150
10½"	1,210	1,500	1,750	1,900	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800	2,900	3,000	3,100	3,200
11"	1,260	1,550	1,800	1,950	2,050	2,150	2,250	2,350	2,450	2,550	2,650	2,750	2,850	2,950	3,050	3,150	3,250
11½"	1,310	1,600	1,850	2,000	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800	2,900	3,000	3,100	3,200	3,300
12"	1,360	1,650	1,900	2,050	2,150	2,250	2,350	2,450	2,550	2,650	2,750	2,850	2,950	3,050	3,150	3,250	3,350
12½"	1,410	1,700	1,950	2,100	2,200	2,300	2,400	2,500	2,600	2,700	2,800	2,900	3,000	3,100	3,200	3,300	3,400
13"	1,460	1,750	2,000	2,150	2,250	2,350	2,450	2,550	2,650	2,750	2,850	2,950	3,050	3,150	3,250	3,350	3,450
13½"	1,510	1,800	2,050	2,200	2,300	2,400	2,500	2,600	2,700	2,800	2,900	3,000	3,100	3,200	3,300	3,400	3,500
14"	1,560	1,850	2,100	2,250	2,350	2,450	2,550	2,650	2,750	2,850	2,950	3,050	3,150	3,250	3,350	3,450	3,550
14½"	1,610	1,900	2,150	2,300	2,400	2,500	2,600	2,700	2,800	2,900	3,000	3,100	3,200	3,300	3,400	3,500	3,600
15"	1,660	1,950	2,200	2,350	2,450	2,550	2,650	2,750	2,850	2,950	3,050	3,150	3,250	3,350	3,450	3,550	3,650
15½"	1,710	2,000	2,250	2,400	2,500	2,600	2,700	2,800	2,900	3,000	3,100	3,200	3,300	3,400	3,500	3,600	3,700
16"	1,760	2,050	2,300	2,450	2,550	2,650	2,750	2,850	2,950	3,050	3,150	3,250	3,350	3,450	3,550	3,650	3,750
16½"	1,810	2,100	2,350	2,500	2,600	2,700	2,800	2,900	3,000	3,100	3,200	3,300	3,400	3,500	3,600	3,700	3,800
17"	1,860	2,150	2,400	2,550	2,650	2,750	2,850	2,950	3,050	3,150	3,250	3,350	3,450	3,550	3,650	3,750	3,850
17½"	1,910	2,200	2,450	2,600	2,700	2,800	2,900	3,000	3,100	3,200	3,300	3,400	3,500	3,600	3,700	3,800	3,900
18"	1,960	2,250	2,500	2,650	2,750	2,850	2,950	3,050	3,150	3,250	3,350	3,450	3,550	3,650	3,750	3,850	3,950
18½"	2,010	2,300	2,550	2,700	2,800	2,900	3,000	3,100	3,200	3,300	3,400	3,500	3,600	3,700	3,800	3,900	4,000
19"	2,060	2,350	2,600	2,750	2,850	2,950	3,050	3,150	3,250	3,350	3,450	3,550	3,650	3,750	3,850	3,950	4,050
19½"	2,110	2,400	2,650	2,800	2,900	3,000	3,100	3,200	3,300	3,400	3,500	3,600	3,700	3,800	3,900	4,000	4,100
20"	2,160	2,450	2,700	2,850	2,950	3,050	3,150	3,250	3,350	3,450	3,550	3,650	3,750	3,850	3,950	4,050	4,150
20½"	2,210	2,500	2,750	2,900	3,000	3,100	3,200	3,300	3,400	3,500	3,600	3,700	3,800	3,900	4,000	4,100	4,200
21"	2,260	2,550	2,800	2,950	3,050	3,150	3,250	3,350	3,450	3,550	3,650	3,750	3,850	3,950	4,050	4,150	4,250
21½"	2,310	2,600	2,850	3,000	3,100	3,200	3,300	3,400	3,500	3,600	3,700	3,800	3,900	4,000	4,100	4,200	4,300
22"	2,360	2,650	2,900	3,050	3,150	3,250	3,350	3,450	3,550	3,650	3,750	3,850	3,950	4,050	4,150	4,250	4,350
22½"	2,410	2,700	2,950	3,100	3,200	3,300	3,400	3,500	3,600	3,700	3,800	3,900	4,000	4,100	4,200	4,300	4,400
23"	2,460	2,750	3,000	3,150	3,250	3,350	3,450	3,550	3,650	3,750	3,850	3,950	4,050	4,150	4,250	4,350	4,450
23½"	2,510	2,800	3,050	3,200	3,300	3,400	3,500	3,600	3,700	3,800	3,900	4,000	4,100	4,200	4,300	4,400	4,500
24"	2,560	2,850	3,100	3,250	3,350	3,450	3,550	3,650	3,750	3,850	3,950	4,050	4,150	4,250	4,350	4,450	4,550
24½"	2,610	2,900	3,150	3,300	3,400	3,500	3,600	3,700	3,800	3,900	4,000	4,100	4,200	4,300	4,400	4,500	4,600
25"	2,660	2,950	3,200	3,350	3,450	3,550	3,650	3,750	3,850	3,950	4,050	4,150	4,250	4,350	4,450	4,550	4,650
25½"	2,710	3,000	3,250	3,400	3,500	3,600	3,700	3,800	3,900	4,000	4,100	4,200	4,300	4,400	4,500	4,600	4,700
26"	2,760	3,050	3,300	3,450	3,550	3,650	3,750	3,850	3,950	4,050	4,150	4,250	4,350	4,450	4,550	4,650	4,750
26½"	2,810	3,100	3,350	3,500	3,600	3,700	3,800	3,900	4,000	4,100	4,200	4,300	4,400	4,500	4,600	4,700	4,800
27"	2,860	3,150	3,400	3,550	3,650	3,750	3,850	3,950	4,050	4,150	4,250	4,350	4,450	4,550	4,650	4,750	4,850
27½"	2,910	3,200	3,450	3,600	3,700	3,800	3,900	4,000	4,100	4,200	4,300	4,400	4,500	4,600	4,700	4,800	4,900
28"	2,960	3,250	3,500	3,650	3,750	3,850	3,950	4,050	4,150	4,250	4,350	4,450	4,550	4,650	4,750	4,850	4,950
28½"	3,010	3,300	3,550	3,700	3,800	3,900	4,000	4,100	4,200	4,300	4,400	4,500	4,600	4,700	4,800	4,900	5,000

*Ledeen Mfg. Co.
3338 North Gilman Road
El Monte, California*

NORTHWEST

oming. The investigation is being made because of high transportation costs of ore to the mill at Edgemont, South Dakota.

Silver-lead production has been resumed by Whitedelf Mining & Development Company near Clark Fork, Bonner County, Idaho following completion of a \$260,000 exploration program with assistance of the Defense Minerals Exploration Administration. Work included 430 feet of sinking and 2,600 feet of drifting on the new 800-foot level. The company's 50-ton mill is being put on a two-shift basis. Concentrates are hauled to the Bunker Hill smelter, Kellogg. Compton I. White Jr., Clark Fork, is manager, and E. I. Fisher, Spokane, secretary-treasurer.

Clayton Silver Mines has found more and richer ore on the new 500-foot level of its mine near Clayton, Custer County, Idaho than on upper levels. Silver ratio now is three ounces to each 1 percent of lead. Production is at mill capacity of 100 tons daily. Norman M. Smith is manager.

A depth of 4,000 feet has been reached by Sunshine Mining Company's main Jewell shaft in the Silver Belt of the Coeur d'Alene mining region, Shoshone County, Idaho. Initial objective will be opening of a new working level on the Silver Syndicate fault-vein. Production by Sunshine from its own and adjoining mines has been averaging about 16,500 tons monthly. Brad Johnson is president.

Lead-silver-zinc values have been improving with depth at the Idaho Goldfields, Inc. property near the summit of Fourth of July Canyon, east of Coeur d'Alene, Kootenai County, Idaho. An inclined shaft has reached a length of 128 feet and depth of 70 feet. Work is being done under a split-check lease by Clyde Napier and Arlie Airthart of Pine Creek. L. A. Thompson of Spokane is president of Idaho Goldfields.

Salmon River Scheelite is doubling its milling capacity to 50 tons. The mill is northwest of Clayton, Bayhorse district, Custer County, Idaho. First shipment of tungsten concentrates was made recently. It went to the Wah Chang Corporation's refinery at Glen Cove, New York. The mining firm hopes to construct its own refinery at Salmon. A large tonnage of ore has been developed and partially blocked out during the past 18 months. Harvey Penney of Salt Lake City is president.

Black Bear Silver-Lead Mines Company has shipped a car of lead concentrates made from ore taken from the old Black Bear mine near Gem, Shoshone County, Idaho. Metropolitan Mines Corporation of Wallace, owns controlling interest.

Underground mining operations are under consideration by Austin

-NORTHWEST

5% months yearly. Because of the high silica content (85 percent), the ore has been shipped directly to the Tacoma, Washington smelter of *American Smelting and Refining Company*. Robert B. Austin, Wallace mining engineer, is president; Otto Meyer of Athol is manager; and Carl C. Leithe of Spokane is secretary.

A diamond drilling program is planned by *R & G Mines, Inc.* at its property in the Beaver Creek area north of Wallace, Shoshone County, Idaho. The work would probe two veins below the adit level. At last report, miners were raising in a shoot of lead-silver ore. Ray Klepinger of Kellogg is president and manager.

Calcium tetravenedite, a new mineral discovered in a mine owned by *J. R. Simplot Company* of Boise, Idaho, has been named "simplotite" in honor of Mr. Simplot.

Silver Star-Queens Mines, Inc. has been opening stopes off the 600-foot winze level and sinking on the Queen footwall vein at its *Queen of the Hills* property in Blaine County, Idaho. Direct shipping ore netted about \$85,000 in net smelter returns in a recent five-month period. Garfield Voget is president.



The *Anaconda Company* of Butte, Montana has returned to a five-day week because of the present copper surplus and falling copper price. The company has shut down the *Original*, *Belmont*, and *Stewart* copper mines. Progress is being made on the company's new Northwest development. The Missoula Gulch headframe has been completed, and the surface buildings at the mine are under construction. Surface structures are also being constructed at the new Ryan shaft site in preparation for sinking this large cross-section shaft.

Golden Anchor Mining and Milling Company is milling ore from the *Evening Star* and *Black Jack* mines near Elliston, Montana, in its new 50-ton gravity mill. The ore carries values in lead, zinc, silver and gold.

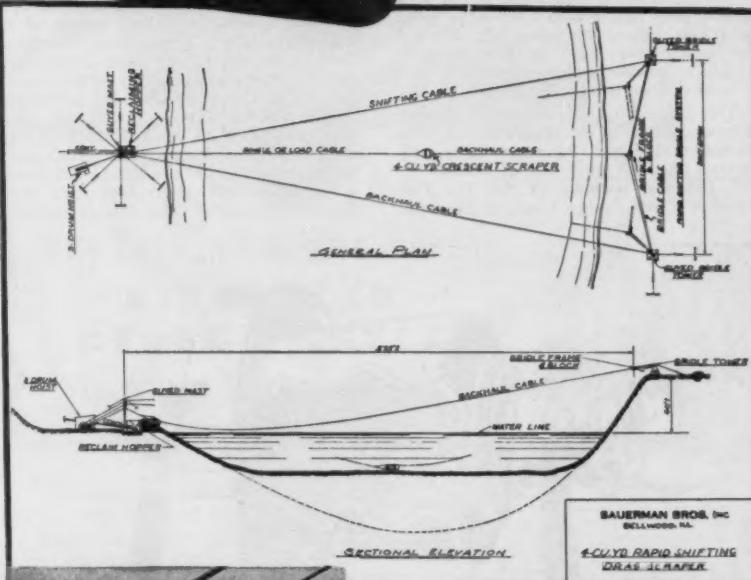
Development of a uranium prospect on the West Fork of the Bitterroot River, south of Darby, Ravalli County, Montana has been undertaken by *Hypotheek Mining and Milling Company* and *National Uranium Corporation* of Wallace, Idaho. Uranium mineralization occurs in a green phyllite formation as gummite and pitchblende and in footwall quartzite fractures as uranophane. Consideration is being given to sinking on one of the high-grade outcroppings. John T. Kingsbury, Wallace, is president of National Uranium.

The *Running Wolf* iron ore mine of *Young Montana Corporation* at Stanford, Montana made several regular shipments before winter weather caused shutdown. The first commercial shipment went to the *Jones & Laughlin Steel Corporation* at Pittsburgh, Pennsylvania. E. A. Young of Hibbing, Minnesota heads the firm.

Umont Mining Company of Salt Lake City, Utah has received an \$82,820 DMEA loan to explore its manganese property near Butte, Montana. The loan

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covers about 1,000 feet of drifting, minor surface drilling, and additional underground drilling at the *Norwich* mine. This property was formerly owned and operated by a partnership of Bob Nelson and Joe Irving.

George O'Brien reports discovery of a lead deposit in the *Iron Chancellor* mine near Gilt Edge, Montana. Mr. O'Brien has a five-year lease on the property which is a branch of *Virgin Gulch* and is located close to the *Black Bull* mine.

The *Basin-Jib Gold Mining Company* is now processing development ore from its mine at Basin, Montana in a mill located one half mile east of Basin.

A tungsten showing at the *Tip Top* mine in Deer Lodge County, Montana

will be explored under a .16,540 contract with the Defense Minerals Exploration Administration. A. J. Brimacombe of Anaconda is president of *Tip Top Mining Company* and E. A. Honrath is secretary.

Montana Standard Mining Company, Ltd. reportedly is planning erection of a 100-ton flotation mill next spring at its lead-zinc-silver property near Thompson Falls, Montana. For the past three years, the firm has trucked about 3,000 tons of ore to the *Coeur d'Alene* for processing in the Golconda mill. Installation of a mill at the mine is expected to save considerably on trucking and handling costs, and also will enable the firm to mill lower grade ores which until now have been dumped because of the cost of trucking

over the Burke Summit. The company also plans to sink its shaft an additional 200 feet in an effort to increase ore reserves.



Oregon Metallurgical Corporation's new Albany plant has started commercial production of titanium and zirconium ingots and castings from sponge. It eventually may produce ingots and castings of hafnium, tantalum, and columbium. General manager is Stephen M. Shelton, former Northwest regional director for the *United States Bureau of Mines* at Albany. The Kroll process for reduction of titanium and zirconium was perfected at the Albany metallurgical laboratories of the Bureau under his direction.

Exploration of a mercury deposit at the *Black Butte* mine in Lane County, Oregon will be undertaken by *Mercury & Chemicals Corporation*, a Delaware Corporation, with aid of a \$46,755 Defense Minerals Exploration Administration loan. The approved project will cost an estimated \$62,340. Richard P. Fisher of Eugene, signed the DMEA contract for the company.

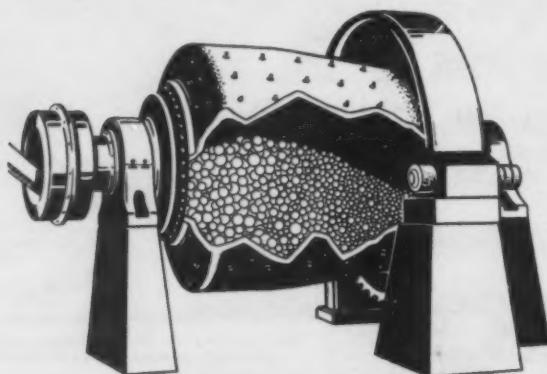
Oregon Drilling and Mining Company of Jacksonville, Oregon has taken options or leases on several mercury prospects in Harney County's Fields-Stees Mountain district. Drilling has been done and more is planned. A. C. Van Galder is president.



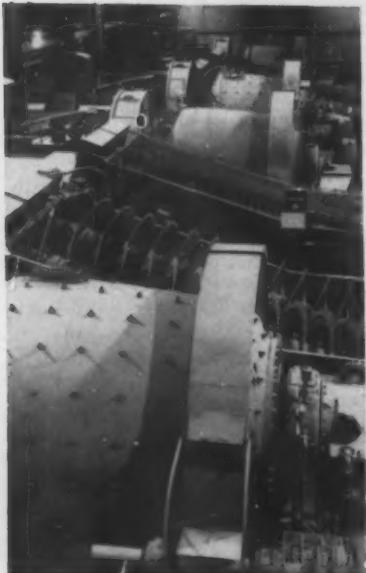
Rare Metals Corporation of America has had a geologist in the Spokane area for several months investigating radioactive deposits and other mineral showings with a view to possibly becoming active in exploration and development work. The geologist is Sherman D. Gardner of Salt Lake City.

Daybreak Uranium, Inc. shipped six tons of low-grade autunite to Winnemucca, Nevada for testing in a portable upgrading mill owned by Edward Meares of Seattle and associates. The company has shipped 10 cars of high grade from its *Huffman* lease in the Mount Spokane district and stockpiled more than 30 cars of low grade estimated to contain less than 0.20 percent uranium oxide. Kae Sowers of Opportunity, Washington is secretary.

The Kennecott Copper Corporation exploration subsidiary, *Bear Creek Mining Company*, has made a \$75,000 third payment to *Glacier Peak Mining and Smelting Company* of Roslyn, Washington on its copper property in northeastern Snohomish County. A total of \$120,000 has been paid since Bear Creek started exploration work in 1953. Work during the past season included 5,000 feet of diamond drilling. Twenty-five men were employed. Transportation to the mile-high property is by helicopter. The project is under direction of Lowell B. Moon, mining geologist in charge of the firm's Spokane district office.



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A. G. Lotze of Colville, Washington has a three-man crew retimbering a burned out 79-foot shaft at the leased Gladstone lead mine near Electric Point, Stevens County. The fire, believed to have been set by an arsonist, caused about \$16,000 damage. The blaze halted mining and shipping of high grade to the *Bunker Hill Company* smelter at Kellogg, Idaho. About \$90,000 worth had been extracted in sinking the shaft.

Western Gold Mining, Inc. has recast the crushing section of its mill in eastern Whatcom County, Washington. Old equipment has been replaced with modern primary and secondary crushers in closed circuit with vibrating screens to properly regulate the sizing of ball mill feed. If a satisfactory recovery of values is obtained by grinding to 10 mesh, it is planned to install a heavy media separation plant. Harry P. Kramer of Seattle is president.

Skookum Uranium Company has been bulldozing and diamond drilling ground near Skookum Lake, Pend Oreille County, Washington. Adam Miller is mining engineer and geologist in charge.

Wire silver has been found on the *Rocky Creek* claims in Pend Oreille County by George Jensen of Evans and Joe McNamee of Northport. Gold, lead, and zinc values also were present in a 12-inch quartz vein. A six-ton shipment to the *Bunker Hill* smelter at Kellogg, Idaho grossed \$135 a ton. Plans included deepening a 20-foot shaft to the 50-foot point and establishing a working level at that horizon.

North Star Uranium, Inc. has been stockpiling autunite uncovered by bulldozing a radioactive area on the *Kessler* lease in the Mount Spokane district, northern Spokane County, Washington. Work is under a 60-40 operating agreement with *Daybreak Uranium, Inc.*, owner of the lease. Ron C. McKelvie of Spokane is president.

National Uranium Corporation of Wallace, Idaho has undertaken exploration of a Mount Spokane district lease held by *Northwest Uranium Mines, Inc.* of Wallace. Roy H. Kingsbury of Wallace is secretary of National Uranium.

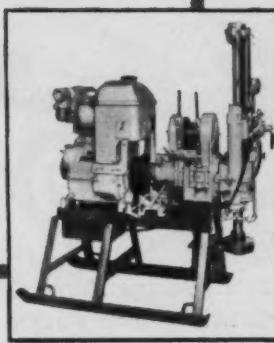
Dahl Uranium Mine, Inc. has been removing saleable timber from its *Dahl* lease in the Mount Spokane district of northern Spokane County, Washington, preparatory to stripping autunite drilled at 16- and 32-foot depths. The lease adjoins the producing *Huffman* lease of *Daybreak Uranium, Inc.* H. J. Tibbits of Spokane is president.

A plant to upgrade uranium ore is planned by *Northwest Uranium Mines, Inc.* at its holdings on the Spokane Indian Reservation in southwestern Stevens County, Washington. Construction is scheduled to start upon completion of metallurgical tests. Initial chemical tests have been favorable. R. R. Porter of Salt Lake City is consultant on metallurgical planning. Drilling has indicated a 14-foot-thick ore body at an average depth of 40 feet. Ore reserves are estimated at 530,000 tons. Dr. F. E. Scott of Wallace, Idaho is president.

Charles D. Madden, Coeur d'Alene; Wayne E. Richards, James M. Shaw, Ross Hersey and David L. Ruse, Spokane; Lloyd A. Eyrich, Newport; and F. S. Clancy, Richland, were among recent mining claim filers at Newport, Pend Oreille County, Washington.



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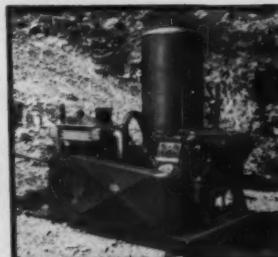
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Mine installation at Rock Springs, Arizona, uses ATLAS COPCO Compressor CT-6 with Deutz 6 cylinder A 6L/514 engine to assure top running efficiency in all temperatures. The semi-portable compressor provides 320 C.F.M.

PARTIAL SPECIFICATIONS TABLE

Model	Cont. BHP/Cont. RPM
F 1 L 612	10/2000
F 2 L 612	20/2000
F 3 L 612	30/2000
F 4 L 612	40/2000
F 6 L 612	60/2000
A/F 2 L 514	30/1600
A/F 3 L 514	45/1600
A 4 L 514	60/1800
A 6 L 514/614	90/1800
A 8 L 614	120/1800
A 12 L 614	180/1800

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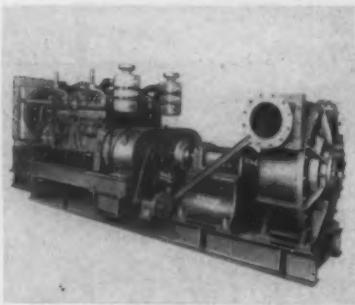
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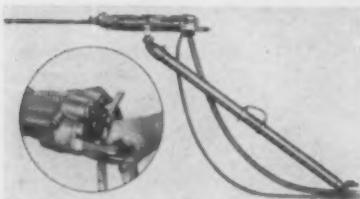
PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.



New Dredge Pump Can Handle 6-inch Rocks

The Krogh Pump and Equipment Co., manufacturers of sand, slurry, and dredge pumps, have recently completed construction on a new, heavy-duty, 12-inch dredge pump. Capable of handling rocks over 6-inches in diameter, the fully lined pump is designed to handle more than 5,000 gpm of mud, sand, gravel, and water, pumping to a distance of over a half a mile or more when needed under special operating conditions. The pump, designed to move more than 200 cubic yards of dry material per hour, is equipped with replaceable Ni-hard liners, and is powered by twin International Diesels rated at 380 hp. Provisions are made in the design and construction of the pump for wear adjustment take-up, a special design feature unique with the new Krogh pump. This adjustment does not require dismantling the pump or piping. Circle No. 75 for further information.



New Jackleg Features Automatic Retraction

A new rock drill with automatic retraction of its integral pusher leg and all controls concentrated on the backhead for single-hand drilling operation, now is available from the Atlas Copco group of companies.

Machine "down time" for new positions and steel changes are held to a minimum by the automatic leg retraction feature, controlled by a handle grip and operated without shutting off the drill. In actual operation, the driller exerts moderate pressure on the hand grip to release his feed pressure, and further depresses the

control to retract the stinger in the leg. Releasing hand pressure automatically stops retraction and restores full feed pressure. Circle No. 80 for the full story.



Torque Converter Model Motor Grader Announced

A new addition to their Adams line, a torque converter model of the big "660" motor grader, has been announced by LeTourneau-Westinghouse Company of Peoria, Illinois. Designated as the Adams Power-Flow 660, the unit has basically the same design features as the standard model "660" with the additional operational advantages of a torque converter drive train plus a 27 per cent increase in engine power. The grader has a 190 hp Diesel engine coupled to a single-stage torque converter and four range constant mesh transmission. This drive system provides the equivalent of an infinite number of gear ratios which adjust automatically to variations in load requirement. Circle No. 64 for further information on this new unit.

loader" tractor-shovels. These are the model HH with a payload capacity of 1½ cubic yards, and the model HU with a capacity of 1½ cubic yards.

Numerous new features have been incorporated in the design of both of these units including the new Hough-designed and manufactured "Paylomatic" powershift transmission. The necessity of coming to a stop for a "range-shift" is completely eliminated with this new "no-stop" transmission since all shifts in both forward and reverse can be made without even slowing down. Circle No. 68.



Radical Mineral Jig Uses Sound and Air to Operate

Bico, Inc., of Burbank, California, have recently introduced the Bico-Osborne Sonic Pneuma Jig. Operating without water, the new mineral jig utilizes high frequency sound waves and air pulsations to separate minerals from their gangue. The S.P.J. system of ore concentration may be used on any ores amenable to ordinary wet gravity concentration. Ore being processed through the jig is kept in periodic suspension by pneumatic pulsations. While particles are in suspension they are subjected to sonic vibrations of a frequency which will cause the particles to vibrate at their natural resonant frequency; this aids in the destruction of any frictional bond between mineral and gangue. Thus the heavy minerals are free to sink into the jig bed and the lighter gangue material moves upward through the jig bed to be discharged as tailings.

The Bico-Osborne Sonic Pneuma Jig is a portable model that can be used for either field or lab testing, and may be operated with either a two hp gasoline engine, or a one hp electric motor. A capacity of 750 to 2000 pounds per hour, depending upon the ore, may be realized. Circle No. 73 for further information.



New "Payloader" Models Feature Easy Operation

The Frank G. Hough Co. has announced the introduction of two new four-wheel-drive, pneumatic-tired "Pay-

GRINDING EQUIPMENT: Comprehensive technical data, and detailed information on the complete U.S. Stoneware lines of grinding and mixing equipment, are described in a recently released catalog, which also incorporates a special chapter dealing with principles of Jar, Ball, and Pebble milling. Various types of mills, linings, and grinding media are also discussed. Circle No. 1 for your copy.

DRYGALV: A cold galvanizing compound, that rustproofs iron and steel surfaces, prevents corrosion at welded joints, and repairs damaged galvanized surfaces, is illustrated and described in a new, four page, folder released by American Solder & Flux Co. Drygalv, a zinc compound, can be applied by brush or spray gun to produce an approximate 95 per cent metallic zinc coating. Circle No. 2 for your copy.

NEW MINERALIGHT: White's Electronics Company have recently developed a new ultra-violet prospecting lamp, called the Oremaster Super Mineralight. Among the many new features incorporated in this instrument are a sliding filter for changing wavelengths of light for different types of minerals, a light-weight probe, built-in voltmeter to check battery. The whole unit weighs only six pounds. Circle No. 3 for further information.

ALLOY STEEL TRACTOR PARTS: A new six-page pamphlet on Manganese Steel tractor replacement parts has been prepared by the AMSCO Division of the American Brake Shoe Company. The folder illustrates and points out the advantages of Manganese Steel in track shoes, scrapers, blades, end bits, sprocket, and idler rims, and grouser bars. Circle No. 4 for your copy.

SHOVEL-CRANE CATALOG: Recently released by the Link-Belt Speeder Corporation, a new 8-page catalog describing the complete line of Link-Belt shovels-cranes is now available for you. Descriptive information on more than 20 new models, all fully convertible to any standard front-end attachment, is featured. Circle No. 5 for your copy.

TRACTOR-COMPRESSOR: Le Boi Division of the Westinghouse Air Brake Company has now available new literature on the Tractair, self-contained compressor-tractor. The use of various attachments such as a front end loader, rock drills,

etc., with their applications are fully illustrated in this new literature. Circle No. 6.

PORTABLE pH RECORDER: Portable, self-contained, pH measuring and recording instruments, requiring no external power supply are now available for field surveys, as well as in-plant studies, at locations where a permanently mounted pH recorder is not desired; or where power is not available. For further information circle No. 7.

SPANISH PUMP BULLETIN: The De Laval Steam Turbine Company has issued a new bulletin in Spanish describing its Series 21S and 2KS two-stage horizontal pumps. Detailed information for both regular and high-temperature operation, as well as performance data on dimensions for various pump sizes in both series is given. Circle No. 8 for your copy.

PORTRAIT OF THE EARTH is the title of a new 23 minute, color, sound, 16 mm film available to you by Hycon Aerial Surveys, Box T, Pasadena, California. This educational film on airborne geophysics and aerial photography, available without charge, covers the airborne magnetometer, sitemeter, and electromagnetic surveys, including color shots over California, Colorado Plateau, and the Peruvian Andes. Contact the company, or circle No. 13.

PIPE WRAPPING TECHNIQUES: Techniques for protecting underground pipe from corrosion with "Scotchrap" brand pipe insulation tape is the subject of a new how-to-do-it booklet released by Minnesota Mining and Manufacturing Co. The 24-page booklet gives instructions for wrapping bends, elbows and short sections, patching pipe with tape, and many other suggestions regarding pipe wrapping. Circle No. 16.

CONVEYOR SCALES: The Howe Conveyor Scale Company has available for you a brochure covering their line of conveyor scales, and continuous weighing services. The Howe scales, with an accuracy of 1/10 of one per cent, may be added to your existing conveyors or inserted as a self-contained unit in your present material handling flow. Circle No. 20 for your copy.

NEW WILLYS ENGINE: The Industrial Engine Department of Willys Motors, Inc., has announced development of a new

"Jeep" Heavy Duty six-cylinder engine for industrial use. The engine was designed specifically to produce high torque at low speeds. Extra durability has been provided for engine components which may be subjected to excessive wear. Circle No. 21 for additional information.

MINERALAB: A new, compact fluorescence analysis cabinet for rapid, positive identification under ultra-violet light, is being introduced by Ultra-Violet Products, Inc. The Mineralab is a complete, self-contained unit for in-the-field or laboratory analysis. Cabinet contains both short and long wave ultra-violet lamps as well as white light for comparison purposes, all operating with push button ease. Circle No. 22 for further information.

THE D9 IN ACTION is the title of a new brochure released by the Caterpillar Tractor Company. Pictured throughout the booklet are application shots of the D9, working on a full range of jobs, under all working conditions. Circle No. 23 for your copy of this interesting booklet.

APPLICATION ENGINEERED is the title of an informative booklet released by Dorr-Oliver Inc., detailing the complete line of Dorr-Oliver pumps available to the industry. Included also are photographs and wash and line drawings of the units as well as performance, range, and power requirement charts. Circle No. 24 for your copy.

REDWOOD TANKS: The George Windeler Co. Ltd., manufacturer of redwood tanks, have recently published a brochure on their various types of tanks available for the industry. Excellent technical information is also given on the characteristics of redwood, and why it makes good tank material. Many redwood tanks are currently being used in uranium mills where they successfully store corrosive liquids. Circle No. 25 for your copy.

ALL-PURPOSE RESUSCITATOR: According to the manufacturer, the National Cylinder Gas Company, the all-purpose "Handy" resuscitator is dependable, simple to operate, and light enough for one person to be carried easily. The unit can be used both as a resuscitator and as an aspirator. Circle No. 38 for further information.

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veyor loading of ore, rock and other abrasive materials, is announced by Galion Allsteel Body Company. One of the many new features is a 15° 24-inch scow end which eliminates the need for a tail gate. Find out more, circle No. 39.

MOTO-CRANE CATALOG: The Thew Shovel Company, has recently published a 16-page catalog describing its new 35-ton Lorain Moto-Crane, model MC-530W, recently added to the Lorain line of power shovels and cranes. The bulletin fully describes fully several of the new features of this entirely new design, high capacity, heavy-duty lifting crane that is transportable over the highways. Circle No. 40 for your copy.

BALL BEARING SWIVELS: The General Machine & Welding Works, Inc. have available for you a complete line of ball bearing swivels in capacities from 700 lbs to 250 tons. Many varieties of swivel hooks are available, and special adaptations are designed on request. Circle No. 41 for a complete catalog.

TWIN-POWER SCRAPER: Euclid Division of General Motors Corporation has recently released new literature describing the Model TS-18 Twin-Power Scraper. The catalog explains the twin-power principle, in which there are two engines of 218 hp each, one in the tractor and one behind the bowl, each driving an axle through a separate Toromatic Drive. Circle No. 42 for your copy.

METALLIC POWDER CUTTING equipment by Airco Company International is described in their new brochure. The booklet covers their complete line of metallic powder cutting equipment for cutting and washing stainless steels, other high alloy steels and cast iron. Circle No. 43 for your copy.

LUBRICATION SPRAY EQUIPMENT: A new brochure recently released by the Farval Corporation, provides complete information on Farval Spray Lubrication systems for open gearing and slide surfaces. Manual and automatic systems with their component parts are described. Circle No. 44.

COMPRESSOR TROUBLES: A new booklet to help locate and correct common air-cooled and water-cooled compressor troubles has been released by Worthington Corp. A cartoon sequence pictures a full description of compressor troubles, from failure to deliver air to excessive

oil consumption. Circle No. 45 for this booklet.

REPLACEMENT PARTS: The Export Division of American Brake Shoe Company has just published a four-page bulletin for contractors describing and illustrating manganese steel replacement parts for earthmoving and crushing equipment. Circle No. 47 for your copy.

SINGLE ROLL CRUSHERS: Rockmaster Single Roll Crushers are the subject of a new 6-page technical data bulletin published by McLanahan & Stone Corp. The brochure includes data on all principal components of the crushers, as well as material on the development of single roll crushers. Circle No. 48 for your copy.

START PILOT: a new device to provide quick starting for all gasoline and Diesel engines at temperatures down to minus 60°, is now available. The compact unit injects from a capsule, a small quantity of ignition-promoting fluid as a fine spray, mixed with air, into the engine intake manifold. Circle No. 49 for further information.

MOTOR DRIVES with positive pulley adjustment, ranging from $\frac{1}{2}$ to 25 hp, is the subject of a new 8-page bulletin offered by Worthington Corporation. Complete information is contained on how to select variable speed drives to meet any specialized requirement. Circle No. 50 for your copy.

MARCY MILLS: The Mine and Smelter Supply Co. have available for you a new catalog describing their Marcy grinding mills. Some of the features of the mill described in the catalog are removable, special bronze alloy bushing which will not scour, and is easy to replace; self-aligning ball and socket trunnion bearings, Meehanite Metal heads, and many other useful features. Circle No. 51 for your copy.

ARE YOUR MEN WASTING TIME looking for lost lock pins on sheave blocks? Joy Mfg. Co.'s quick opening sheave blocks have lock pins that can't be lost. The block is loosened by a non-removable key which can't be lost in the muck pile. These sheave blocks are available in sizes ranging from 6 inches to 20 inches with safety hook, swivel hook, eye-bolt, or clevis attachments. A bulletin is available which gives all the details. Circle No. 52.

GYRATORY CRUSHER BULLETIN: Complete specifications and descriptions of the TC gyratory crushers manufactured by Traylor Engineering & Mfg. Co. are available in bulletin form. The TC primary crushers range in size from 20 inches to 60 inches. For your copy of this informative bulletin, circle No. 53.

CONTROLLED FEED BY WEIGHT: The "Feedoweight," made by Merrick Scale Mfg. Co. will correctly and uniformly feed material by weight. If your operation requires careful feeding and proportioning of material by weight, or if you have special feeding problems, you will want a copy of the Feedoweight Bulletin. Circle No. 54.

DRILL SUPPLY CATALOG: A new 40-page catalog, available from the Acker Drill Co., Inc., illustrates and describes over 150 drilling tools and accessories for core drilling, auger borings, and soil sampling. Drill operators will want a copy of this catalog for money-saving ideas on the latest type of equipment available. Circle No. 55.

STORAGE-BATTERY LOCOMOTIVES: General Electric Co. has a 12-page brochure available which describes its line of battery locomotives for mining and other uses. Sizes range from $1\frac{1}{2}$ ton to 10 ton in a wide variety of heights, widths, and track gages. If you are thinking of buying storage-battery locomotives for a new operation or replacing present locomotives, you will want a copy of this brochure. Circle No. 56 for your copy.

WET AND DRY CRINDING MILLS: Hardinge Co., Inc. has recently issued a 6-page brochure covering its major types of reduction mills for both wet and dry grinding and pulverizing. Triconic rod, cylindrical tube, batch, conical and disc-roll mills are described. For your copy, circle No. 57.

MINE SURVEY CREWS will be interested in Thor Power Tool Co.'s new idea for setting underground survey spuds with a minimum of delay time for the mine crew. You can quickly and easily drill your own spud holes with the Thor Air Hammer which weighs only 14 pounds, and comes with a 50-ft. length of $\frac{1}{4}$ inch air hose, and a $\frac{1}{8}$ inch tungsten-carbide bit. It's not hard to see how handy this would be for underground surveyors. Circle No. 58 for details.

*For Free Product Literature
see other side*

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Control Flotation Circuit Alkalinity Automatically

Close control of alkalinity in many flotation circuits is a difficult problem. Close control is imperative for highest metallurgical recoveries. Many mills control alkalinity with lime which complicates the problem because circuit alkalinity is so great that it cannot be measured with ordinary instruments, such as a pH meter.

For such circuits an automatic titrator which automatically controls lime addition has been developed by the Industrial Physics and Electronics Company of Salt Lake City, Utah.

The new titrator-controller mixes a constant amount of acid with a constant amount of filtered flotation pulp and measures the pH of this mixture. If the titration is correct, the pH should then be equal to "7," which is the neutral point for the solution. If this is the case, then the controller, shown in the upper left of the above picture, takes no action to change the lime feed.

The instrument is entirely automatic in that it automatically samples the solution, titrates it, divests itself of its spent solution, washes the electrode assembly automatically, and repeats the process, over and over, once each minute. Circle No. 62 on the PEP card for information on this new machine.



Dart Truck Company Adds New 35 Tonner To Line

The new Dart carries 24 cubic yards struck, and has 18:00 by 33 rear tires 32 ply, and 18:00 by 25, 32 ply front tires.

Claiming "Power for the climb and speed for the haul road," the new model utilizes a 400 H.P. diesel driving through a down-hill retarding torque converter and a special design, heavy-duty 3-speed transmission.

Stressing safety and comfort for the driver, the cab is designed for entirely

automatic air-conditioning if it is desirable. Built unusually strong, DART's tubular 50,000 pound front axle and DART's triple reduction planetary 110,000 pound driving axle far exceed the gross vehicle weight of 126,000 pounds. Circle No. 66 for further information.



One-Door Bottom Dump Car Developed by S-D

Clean shedding is one of the most important features of the one-door bottom dumping mine car developed for use on narrow track gauges by Sanford-Day Iron Works, Inc. of Knoxville, Tenn. The one-door design also offers a greater cubic foot capacity for the same overall dimensions than has been possible to obtain in granby or rocker dump designs according to the manufacturer.

Outside frame construction of the new car permits a maximum door-opening width between the bottom flanges of the rails, for faster dumping, as well as providing a low center of gravity for improved trackability. Circle No. 79 for further information on the one-door bottom dump car.



Convert Your Cat D4 To a Hydraulic Backhoe

The Hyster D4 hydraulic backhoe, designed for the Caterpillar D4 Tractor by the Hyster Co. of Peoria, Illinois, has full track-type tractor mobility. It is capable of digging down to 13 feet and loading up to a height of over 9 feet. A rack and gear swing mechanism, operating in an oil-tight case, provides full swing power at uniform speed throughout a full 240 degree arc.

For ease in negotiating rough terrain, the Hydraulic Backhoe incorporates an equalizer which allows full track oscillation. The equalizer may be locked to obtain rigid-tractor stability. Retractable hydraulic outriggers provide full machine stability. Dipper for the new D4 Backhoe are available in cutting widths of 13, 21 or 29 inches. Circle No. 76.

Notes From The Manufacturers

The Santa Fe Tank and Tower Company has recently been acquired by the Flour Products Company, a division of the Flour Corporation Ltd. The company will be known as the Santa Fe Tank Division of the Flour Company and will continue to manufacture quality wood tanks and pipe, with special emphasis on the uranium industry needs. The new division, with L. D. Oberts as general manager, will have headquarters at 12000 East Washington Boulevard, Whittier, California.

Albert T. Metcalf has been named electrical engineer for Nordberg Manufacturing Company, Milwaukee, Wisconsin. In this position he will assist all product engineering, manufacturing, and sales departments and will maintain liaison with electrical equipment manufacturers.

Kenworth truck sales facilities were expanded recently when Texas Kenworth Corporation moved into its new \$300,000 building at 7901 Harry Hines Boulevard in Dallas, Texas.

Dr. Robert A. Cooley, formerly with Olin Mathieson Chemical Corporation, is now associated with a new company, the Propelllex Chemical Corporation in Edwardsville, Illinois. Propelllex will conduct research and development on propellants and explosives. Major emphasis for the petroleum and mining field will be placed on gas generating devices such as oil well perforators, cement extruders, bridging plugs, and non-electric powered safety devices.

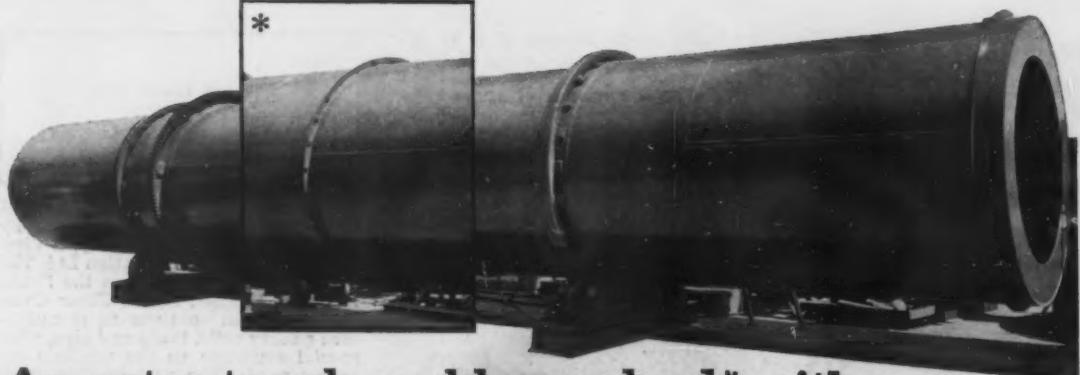
W. J. Klein was appointed vice president and director of sales, and **W. L. Voegeli** was named general sales manager of the Tractor Group, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.

J. C. O'Donnell is the new general manager of Shaft and Dye's ornament Machines Company, Salt Lake City, Utah. The company markets the recently developed Cryderman shaft muking machine, and the Whup d'Whup train car loader.

Gardner-Denver Company (Canada), Ltd., has opened a new district sales and service office in Winnipeg to serve the mining industry throughout Manitoba, western Ontario, and eastern Saskatchewan. District manager in Winnipeg is **J. A. Caverly**, a graduate engineer from Saskatchewan.

Walter J. Kalmeyer has been advanced to vice president and **Clay C. Hooper** has been named assistant general manager of Standard Steel Corporation, Los Angeles. **Norman Pitt** was named chief engineer and **Edward J. Meier**, public relations director.

A complete line of welding electrodes are now manufactured in Santiago, Chile by a new company being formed with the joint ownership by **A. Montero y Cia. S. A.** and **Harnischfeger International Corporation**. The new firm has been licensed by **Harnischfeger Export Corporation**.



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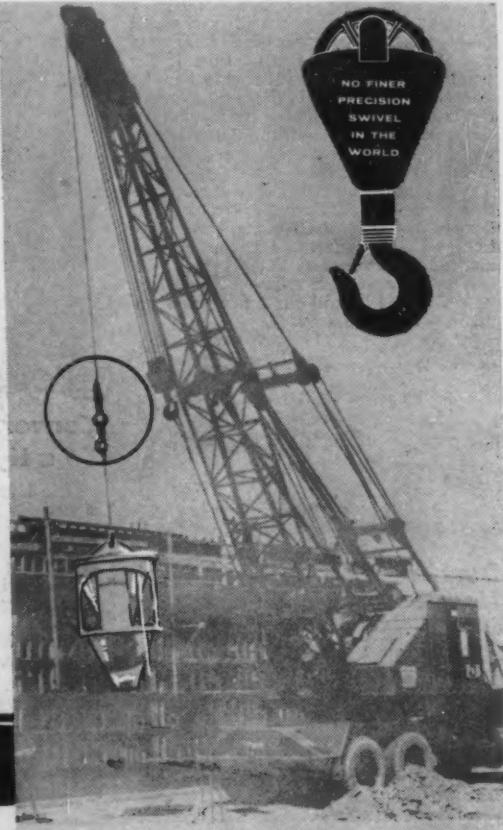
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INTERNATIONAL NEWS



NORTH AMERICA

LABRADOR—Canadian Javelin Ltd. has formed a subsidiary firm, Julian Iron Company Ltd., to develop its extensive iron ore properties on Lake Julian, about 20 miles north of Wabush Lake. Iron mineralization is estimated to be in excess of 500,000,000 tons. The deposit is near the Wabush Lake Railway and would require only a short spur line to bring it into regular use. Negotiations are said to be underway with a foreign steel group to construct a mill.

ALASKA—Production is scheduled to start next spring at the mica property of B. C. Mica Mines of Canada, southeast of Ketchikan near the entrance to the Portland Canal. Exploratory work has been underway at the site for the past three years.

QUEBEC—Sogemines Development Company Ltd. has been formed as an exploration division of Sogemines Ltd. (*Societe Generale des Minerais de Bruxelles, Belgium*) to undertake exploratory work for the parent company. The company will also seek opportunities in the development of mining properties and in the treatment of ores. Headquarters will be in Montreal.

BRITISH COLUMBIA—Kamloops Copper Company, Ltd. is planning to construct a 300-ton concentrator at its properties five miles southwest of Kamloops. Low level development is planned to open ore bodies located by 1956 exploration work. R. W. Kennedy, Kamloops, is secretary.

ONTARIO—Mogul Mining Corporation has optioned a nickel-copper property in Pardee Township, Fort Williams area, from Mattawin Gold Mines. The option calls for \$1,500 cash on signing the agreement, \$5,000 cash by April 1, 1957, and formation of a new company at that time. Work done by Mattawin on the property in 1955 had shown significant values.

LABRADOR—The Iron Ore Company of Canada has changed the name of the Burnt Creek iron ore property on the Quebec-Labrador border to the French mine.

NEWFOUNDLAND—Maritime Mining Corporation is preparing for production of copper concentrate later this year with the recent purchase of a Birdsboro-Buchanan jaw crusher. Maritime reopened the old workings at the Tilt Cove site on Notre Dame Bay in 1954. It had last been operated in 1917.

BRITISH COLUMBIA—Howe Sound Company will develop a 34-claim group of McVicar Mining Company under an agreement recently completed. The property lies about 10 miles southeast of Squamish, B.C., and about 10 miles from the mine and plant of Britannia Mining and Smelting Company, a Howe Sound subsidiary. Presumably, any ore mined would be treated at this plant. Howe Sound has a two-year period in which to examine and explore the property before making a final decision. If the company then decides to proceed with development plans, Howe Sound will advance all funds and will receive 90 percent of all operating profits until

fully reimbursed for pre-production expenses. After that Howe will receive 80 percent of operating profit. In each case, McVicar receives the balance.

ALASKA—The erection of a new dredge at Nome this past summer for U.S. Smelting, Refining and Mining Company was completed by Yuba Manufacturing Company of San Francisco, California. The dredge has been rebuilt from parts of another dredge which capsized two years ago, plus the addition of new equipment. It will be the most modern dredge in the Nome area when launched next season. Jigs are used instead of riffles in gold-saving machinery. The dredge will go into operation in the well known "Submarine area" of Nome. U.S. Smelting will have three dredges in operation in the Nome vicinity next summer.

BRITISH COLUMBIA—Lenwood Mining and Explorations is exploring a recently acquired copper property in the Similkameen Valley about 15 miles from the United States border. A mine access road has been constructed, and six of the nine adits driven by former owners have been cleaned out. Work to date has indicated about 60,000 tons assaying about

4 percent copper. Some gold and silver is also associated.

ALASKA—Approximately \$750,000 was spent by large mining companies in southeastern Alaska during the last season. This money was spent primarily for exploration of mineral deposits, and compares with only a few thousand dollars spent four years ago.

NOVA SCOTIA—Magnet Cove Barium Corporation's Canadian Division, operating at Walton, is currently sinking a 1,000-foot shaft which will convert current, open-pit operations to underground mining sometime later this year. The mine is at present basically an open pit operation. Overburden is stripped, and the barite loosened by small charges of dynamite. Bottom of the pit is now over 300 feet from the surface. Ore is trucked to the mill, a distance of about 3 miles.

ONTARIO—Pronto Uranium Mines Ltd., operating in the Blind River district, has modified its original plans for an extension of the mill because of difficulties in plant operation during the first eight or nine months. The schedule had called for an increase from 1,000 to a rate of 1,500 tons per day by January 1, 1957. This date has now been



INCO Plans \$175,000,000 Manitoba Expansion

The largest nickel producer in the world, International Nickel Company of Canada, Ltd., has disclosed plans for a \$175,000,000 project in the Mystery-Moak Lakes area of northern Manitoba. Simultaneously, the company announced a price boost of 9½ cents a pound, which brings the expert nickel price to 74 cents a pound, including the 1¼ cents of United States import duty. Two new nickel mines, the Thompson and the Moak, will be opened by Inco within the next four years. A concentrator, smelter, and refinery will also be built near the mines. The Manitoba Hydro-Electric Board has approved a new power plant, costing \$32,000,000 to \$38,000,000, which will supply power for Inco's operations and provide for a possible additional industry in that area. The project will be the second largest nickel-producing operation in the world, topped only by Inco's Sudbury operation in northern Ontario, and will raise the company's annual nickel producing capacity 130,000,000 pounds, or 50 percent, to 385,000,000 pounds a year by 1960. The picture above shows the site of an exploration shaft with headframe, oil storage tanks, and surface buildings which partially represent the \$10,000,000 already spent by the company. Inco will invest another \$115,000,000 in the project and will loan \$20,000,000 for the power plant. The company will also advance money for the initial capital costs of a \$5,000,000 30-mile spur line to be installed by Canadian National Railways. The Manitoba ores have very small copper values compared with the high copper content of the Sudbury ore, so the company's copper production will not increase correspondingly with the increase in nickel output. The ores do have minor quantities of cobalt, platinum, palladium, gold and silver, however, which are expected to bring up the value of production at the Manitoba mines. The jump in International Nickel's prices is the largest single advance in the metal's price. The previous record was an 8-cent raise in 1950 from 40 to 48 cents a pound. The last boost was in 1954 when it went from 60 to 64½ cents a pound.

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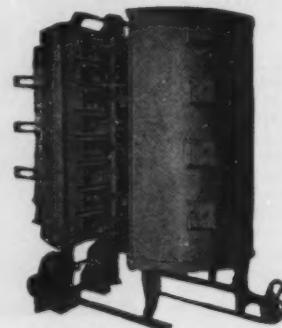
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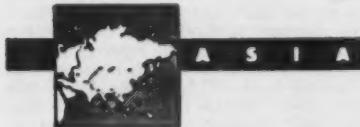
INTERNATIONAL

changed to April, by which time the management hopes to have the \$750,000 extension completed.

ALASKA—Kena Chrome Company has completed its \$70,000 mill at the Star 4 property on Red Mountain near Seldovia. The mill replaces hand sorting methods which were used for the past three seasons, and therefore adds to the tonnage the mine is able to ship by concentration of lower grade material. Trucks will continue to haul the ore 14 miles down the mountain for stockpiling on the beach. Then it is loaded aboard ship by belt conveyor for shipment to the United States.

ONTARIO—Three Koepe friction hoists, have been ordered by Steep Rock Iron Mines, Ltd. for its Hogarth A-2 mine. The hoists will be supplied by Bertram-Nordberg of Dundas, Ontario, and the electrical equipment will be built by Canadian General Electric. Deliveries are scheduled for next August and involve an expenditure of about \$750,000.

ALASKA—Changing hands this past season were two dredging properties on the Seward Peninsula. The Casa de Paga operations on the Innachuk River were purchased by Grant Nelson of Nome who spent part of the season working one of the two dredges. Preparing for a full operation next season will be the Lucky Syndicate of Portland, Oregon which purchased the dredge on the Kougarok River from the Gold Dust Mining Company. Former owners were Jack Bullock and Associates of Kotzebue. This dredge has been idle for the past several years.



JAPAN—Two Japanese firms have signed an agreement which provides for development of an iron ore mine at Endau on the eastern coast of Malaya. Japan Mining Company and Cosmo Company, the two firms involved, have organized Endau Iron Mining Company Ltd. which will be jointly managed. Malaysians will invest 51 percent in the new firm, and the Japanese 49 percent. Development work is scheduled to start in August. The firm hopes to mine 180,000 tons of iron ore annually for shipment to Japan's three large steel mills—Fuji, Yawata, and Japan Steel Tube.

MALAYA—Kamunting Tin Dredging Ltd. has secured an area for the No. 6 dredge which, it is expected, will have to be moved in 1958 when present reserves are depleted. A preliminary estimate of the costs involved indicates that about £475,000 will be required for this transfer. The No. 4 dredge is expected to work out its reserves in the near future, and the No. 5 dredge in about three years' time.

PERSIA—Three new mining firms have been organized in Persia with the aid of foreign capital to develop the country's resources. Khomein Mining Company will develop lead and zinc deposits in Khomein and Gulpaygan; 49 percent of the capital has been subscribed by Penarroya, a French company. Chromite Mining Company will develop chromite deposits at Abbas-Abad; 49 percent of this firm's capital comes from the German com-

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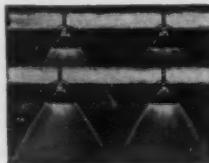
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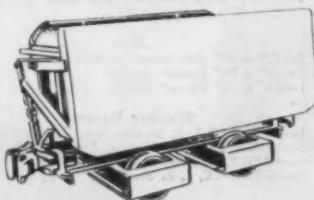
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INTERNATIONAL

pany—Metallgesellschaft. Khaneh Sorme Mining Company will develop lead deposits at Khaneh Sorme; 49 percent of this capitalization also comes from Metallgesellschaft.

JAPAN—Four Japanese smelters are reported to have concluded an agreement with French Special Steel Federation for the import of 20,000 tons of nickel ore from New Caledonia; in return, 300 tons of nickel products would be shipped to France from Japan. The smelters are Shimura Kako, Nippon Mining, Nissos Seiko, and Kamogawa Kako. The nickel products are not to be shipped until after April of this year since the Japanese still have previously contracted goods to ship by the end of March.

INDIA—A final contract for construction of an integrated iron and steel plant at Durgapur in West Bengal has been signed between the government of India and the Indian Steelworks Construction Company of London. The plant will go into production in October 1959, when the first blast furnace will be fired. Full production of the entire plant is to be attained in early 1961. Total cost of the plant is about Rupees 138 crores, of which Rupees 83 crores will be the foreign cost.

MALAYA—The estimated life for the No. 2 dredge of Southern Tronoh Tin Dredging Ltd. is now about 20 months, but this is dependent upon the successful extraction of values from clayey gravel. Failure to recover values (indicated by recent drilling) may mean closing down of the dredge and placing on a care and maintenance basis. The dredging life of the No. 1 dredge is estimated to be another 10 months, but it may be possible to extend this slightly. With this in mind, the company is planning to do some test boring. By the time the reserves for this dredge are exhausted, it is expected that a mining lease will have been issued over two rubber estates in the Sungkau area to which this dredge will be transferred.

KOREA—A United Nations Korean Reconstruction Agency loan of \$50,000 has enabled Korea Rare Elements Development Company to purchase machinery and equipment which will increase the firm's monthly output of monazite. UNKRA engineers have determined that 6,250 metric tons of 80 percent monazite concentrate which would yield an estimated 5,000 metric tons of recoverable monazite are contained in the beach sands at Pi-in on the west coast. An extraction process was also worked out which involved purchase of spiral concentrators and magnetic separators for the Taewha monazite mine owned by the firm. At present, the company ships about 20 metric tons monthly. Modernization of the mine is expected to bring this to 50 metric tons of 80 percent monazite concentrate.



LATIN AMERICA

MEXICO—The Jose Paredes Brothers are working the La Sorpresa mercury mine at Huahuaxtla, municipality of Iguala, state of Guerrero. They have installed an additional six retort furnaces, bringing the total retorts in operation to 72. Weekly production is 500 kilos and this is expected to increase as they open new

faces in the mine. A compressor has been installed to supply air for driving a new adit about 150 feet below the present workings. With this new development work, the management expects to cut other cinnabar ore bodies.

CUBA—*Mine de Matahambre, S.A.* reports that during the period from July through September 1956 its mines in the Pinar del Rio province produced 65,956 tons of chalcopyrite ore. Also 10,881 tons of flotation concentrate were exported to the *American Metal Company* at Carteret, New Jersey.

CHILE—The Export-Import Bank of Washington, D.C. has granted a \$16,000,000 line of credit to the *Compania Salitrera Anglo-Lautaro (Anglo-Lautaro Nitrate Corporation)* to help finance the firm's proposed rehabilitation and expansion program. The program calls for a total expenditure of \$25,000,000, including costs in Chilean pesos, and will include construction of a modern research laboratory, extension and improvement of the solar evaporation plant and process recently developed by the company, construction of facilities for producing additional by-products, mechanization of the port installations at Tocopilla, and further improvement of the housing and other living conditions.

PERU—*Cia. Minera Condoroma, S.A.*, operating the Condoroma lead-zinc-silver mine in the province of Espinar, Department of Cuzco, will double the capacity of its concentrator to 200 daily tons. The first 100-ton section is in operation now, producing 250 tons of 60 percent lead and 200 ounces silver concentrate per month, and 250 tons of 55 percent zinc and 50 ounces silver concentrate per month. This output will be doubled by the middle of the year when the second section will be started and 200 tons or ore will be treated per day. The operating firm is a subsidiary of the Mauricio Hochschild organization. Exploration to date has proven 240,000 tons of ore in the Condoroma property itself, and 100,000 tons in the nearby Kata property, averaging 4 to 5 percent zinc and 20 to 25 ounces silver per ton.

CHILE—*National Tungsten Corporation* of Los Angeles, California has acquired a 50 percent interest in potential tungsten, mercury, and manganese deposits in the Andes Mountains. In an agreement with *Kolombo International Corporation*, also of Los Angeles, National Tungsten also acquired exclusive operating and management rights. A Chilean subsidiary, owned jointly by the two United States firms, will be set up to own and operate the property.

BRAZIL—*Companhia Estanifera do Brasil* has already spent about Cr\$20,000,000 in developing 20 tin ore mine in Brazil since its organization in 1951. The firm is established in Volta Redonda, state of Rio de Janeiro, and buys all of the tin ore produced in Brazil. It, in turn, produces all of Brazil's tin metal needs (2,500 metric tons annually).

PERU—*Empress Minera Huamachuco* which owns the Florida lead and zinc mine in Huamachuco, northern Andes, will start exploration and development of tungsten deposits in the same province.

CUBA—During the period from July through September 1956, *Freeport Sulphur Company's* mines produced 399,357 tons of nickel ore. These mines are located in Oriente Province.

PERU—A strike at the Oroya smelter of *Cerro de Pasco Corporation* closed down operations for several weeks. The Union received a 16 percent wage increase which will be valid for one year.

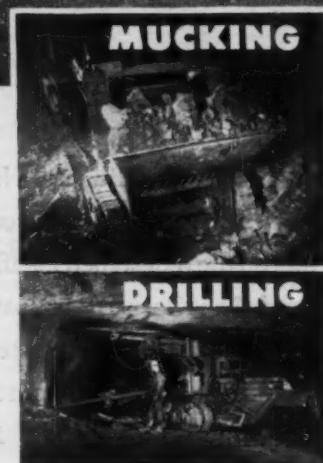


EIRE—Canadian interests are reported to have an option on the old copper mines at Bonmahon, County Waterford. The option requires a payment of \$100,000 for preliminary exploration. Local inter-

ests are investigating copper bodies in the Skibbereen-Schull-Crookhaven district of County Cork, and also old copper mines at Muckross and Ross Island, near Killarney. These mines have not been operated for over a century and the Killarney Trades Council plans to have a Canadian mining expert test ore samples from them. The property on which the mines are located was recently purchased by an American.

NORWAY—Almost 75 percent of Norwegian ore is exported in an unprocessed state, but the current trend is to increase Norway's refining facilities. The only place in Europe where columbite ore is being mined is at the Sove mines in Telemark. These mines are owned by the government and the ore is processed by

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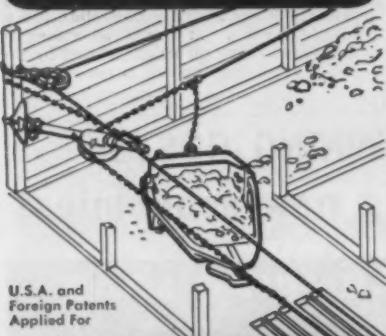


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INTERNATIONAL

the government company A/S *Norsk Bergverk*. The columbite concentrate is a combination of lime, apatite, the columbium mineral copite, and other substances, and contains about eight percent Cb_2O_5 . This preliminary concentrate is sent to *Norsk Hydro's* plant at Porsgrunn, and there is treated with nitric acid which removes the apatite and the lime. The finished concentration containing about 40 to 50 percent Cb_2O_5 is returned to Søve and packed for export. The United States helped to finance Søve production in 1954 through a contract to buy 396 short tons of Cb_2O_5 concentrate at a total price of \$1,765,000. This contract was fulfilled by the time it expired in December 1956. *Norsk Bergverk* now plans to expand operations to form ferro-columbium. A small experimental smelting works will be in operation soon. Although Søve mines are the only producers of Columbium ore in Europe, there are known deposits in Bavaria, Western Germany. Nigeria, Malaya, and Russia also have undeveloped deposits.

EIRE—The main level of the King shaft of *Silvermines Lead & Zinc Company* was extended 439 feet during the September quarter, bringing the total footage sunk to 877 feet. Difficulties at the heavy-media separation plant have been practically overcome, and a second trial shipment of 380 tons of barite was made recently.

AUSTRIA—The recently reported deposits of manganese ore in the province of Salzburg have estimated reserves of 100,000 tons. The *Bayrische Maximilian-Hütte A.G.* plans to begin mining operations through one test adit.

CORNWALL—*Geevor Tin Mines, Ltd.* is considering the sinking of a new shaft near its present, almost depleted, mine. The old mine has currently been existing on lateral development, which cannot last long, and diamond drilling is underway to determine the best location for a new shaft. The cost will be over £250,000 plus additional capital for a plant and equipment. A recent report from the company shows a profit of £100,353 this year compared to £109,706 for last year. The larger profit last year was chiefly due to £50,000 derived from accumulated copper-bearing flotation residues, whereas this year about £19,000 was obtained from this source.

POLAND—In the district of Klobuck, rich iron ore deposits have been discovered. They are reported to be equal in quantity and quality to those of Tschenstochau, and plans for an iron ore mining center are being developed.

AUSTRIA—Copper deposits have been discovered in *Kupferbergwerk Mitterberg*, Salzburg province.

POLAND—Two shafts are now being sunk at the lead-zinc mine at Trzebionka, Stalinogrod Voivodship. Mine production will start in 1959, with output to eventually reach 600,000 tons of ore annually. An ore beneficiation plant is under construction and will also be ready by 1959.

SWEDEN—*Luossavaara Kirunavaara Aktiebolag*, which will be entirely state-owned by next October, will build a new ore harbor near the north Sweden port of Lulea. To be completed by 1961, the

harbor will be able to receive ocean-going vessels of any size. At Lulea when a 13,000-ton ore ship is fully loaded there is only a one-foot clearance from the harbor bottom.

CORNWALL—*Hawkswood Mining Company* recently sold its wolframite property on the northeast edge of Bodmin Moor for £21,000 to a firm with interests in the manufacture of tungsten carbide.

EIRE—*Minerals Development Corporation, Ltd.* has been formed to develop existing mineral deposits in northern Ireland. The company is a private concern, with a capital of £50,000, and will reopen old lead and zinc mines at Kealy in County Armagh.



OCEANIA

NEW SOUTH WALES—*Broken Hill South Ltd.* has decided to exercise its option to purchase the mining leases and plant at Cobar of *New Occidental Gold Mines N.L.* There are extensive low-grade copper-gold deposits at Cobar, exploration of which by *Mines Exploration Pty. Ltd.*

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Ltd. (subsidiary of Broken Hill South Ltd.) may cost several hundred thousand Australian pounds. Broken Hill South undoubtedly has the funds to support such an exploration. The decision to proceed has been made possible by the State government's decision to reduce royalty payments on mineral that may be recovered from the mines.

REPUBLIC OF THE PHILIPPINES—Delays in delivery of equipment and machinery have postponed starting date of *Atlas Consolidated Mining and Development Corporation's* expanded mill capacity. The mill's production will increase from 8,000 tons per day to 10,000 tons daily when the expansion is completed. The present average of 6,000 tons daily has already been exceeded, however; in November 6,901 tons were treated by the mill. Full volume is now expected by the end of March.

NEW SOUTH WALES—Many new rutile firms are now producing. Several who formed during the uranium boom are now in actual production of rutile and zircon. Typical is *Silver Valley Uranium N.L.*, now at Evans Head, which is producing 20 tons of rutile per week. *Tungsten Consolidated, Rye Park Scheelite*, and *Bellingen Titanium* are all producing at roughly comparable rates. Rutile output for New South Wales and Queensland is expected to be at a rate of 100,000 tons by year's end. *National Minerals Ltd.* and *Associated Minerals Consolidated N.L.* have each made large profits in the current term and report increasing production at higher contract prices for both rutile and zircon. Zircon, until recently the cinderella of the beach sands industry, has now come into its own with prices around £A16 per ton. Forward rutile is selling at £70 to £90 with spot mineral around £110 to £115 per ton.

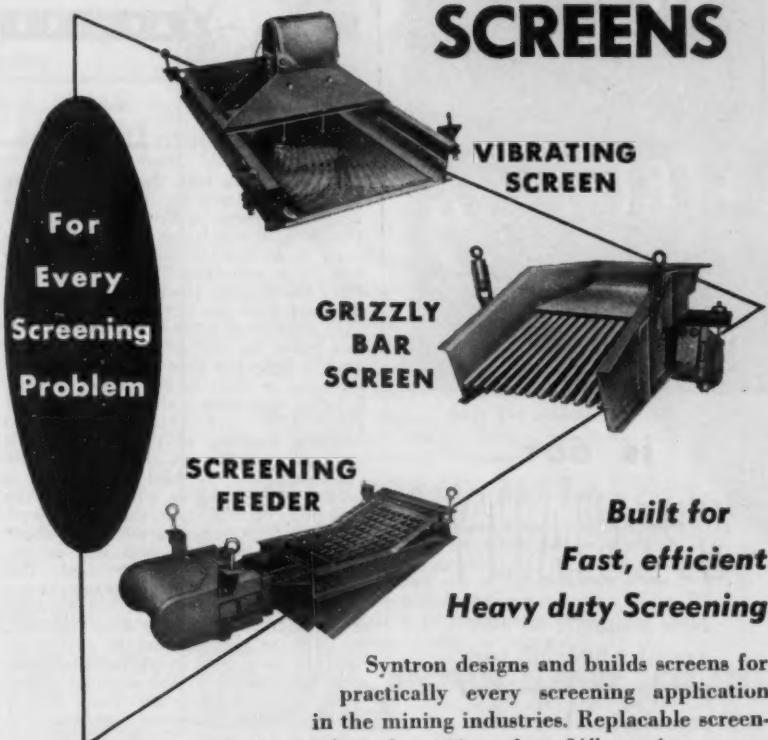
REPUBLIC OF THE PHILIPPINES—According to *Marsman and Company*, managers of *Palawan Quicksilver Mines*, operations of the latter have reached a stable level and a steady monthly output is now assured. The mercury firm has been granted, and since September has been using, barter licenses for 100 percent of its production. In October the company treated 3,896 tons of cinnabar ore in its reduction plant for a production of 22,507.7 pounds of mercury.

TASMANIA—Prospecting of a 7,000-acre nickel-copper area by *Montana Silver Lead N.L.* at Zeehan has revealed payable ore in one section of 700 feet over a 2- to 14-foot width down to 100 feet in depth. Nickel ore has been discovered on the surface at two points, nickel content ranging between 10 percent and 0.25 percent. Copper has been as high as 8 percent. The nickel mineral is rare violarite (Ni_3FeS_2). Since nickel-copper ore has now been found over two miles (at separated points), a geophysical survey will be resumed, followed by scout drilling to 100 feet. The company states that an offer of finance has been made by overseas interests but has not disclosed the name of the interested party.

REPUBLIC OF THE PHILIPPINES—*Palawan Consolidated Mining Company* made its first shipment of high-grade metallurgical chromite ore in November. The 2,000 tons shipment went to *Philip Bros. Inc.* of New York City, which holds the 1956-1957 buying rights. Value of the cargo was \$110,000.

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INTERNATIONAL



UNION OF SOUTH AFRICA—*Hartebeestfontein Gold Mining Co. Ltd.* is now proceeding with the sinking of two additional shafts to facilitate the opening up of the deeper northwestern section of the mine, in which one shaft has already been sunk. One of the two new shafts will be a subvertical unit, to be sunk from the transfer level at a point about 400 feet from the existing shaft, that is, from a depth of 3,096 feet to about 8,300 feet below the surface. The second new shaft, a little less than 4,000 feet east of the existing shaft in the deeper section, is being sunk from surface to a depth of about 5,700 feet. This shaft will also facilitate opening up the deeper levels and will function as the main upcast ventilation unit. A third milling unit is being installed which will increase the gold plant capacity from the current level of about 66,000 tons a month to about 90,000 tons a month; this will be increased further at a later date. The uranium plant, now in production, is expected to operate at the rated capacity of 100,000 tons a month from January, with current residues from the gold plant being supplemented by accumulated residues for feeding to the uranium plant. A higher sorting rate and resue raising (which means increased underground sorting of a substantial portion of the development rock) has contributed to improving the grade of ore treated, and, while working costs per ton milled have thereby risen, the working cost per ounce recovered has been reduced.

MOZAMBIQUE—An exclusive concession to develop certain minerals, excluding radioactive minerals, diamonds, petroleum, and coal, has been awarded by the Portuguese government to *Central Mining & Investment Corporation*. The latter intends to organize a subsidiary company to undertake this work since the concession requires that the new company have administrative headquarters in Portuguese territory. The concession also stipulates that 60 percent of the capital of the new firm must be in Portuguese hands, that its chairman and one-half of its board must be Portuguese, and that it must keep a representative of Portuguese nationality in Mozambique.

FRENCH EQUATORIAL AFRICA—A combine of French, British, Italian, and German interests will build an 85-kilometer cable railway from the *Mouanda* manganese deposit to an unspecified rail-head point. This cable operation reportedly will be the second longest in the world. The *United States Steel Corporation* holds a 49 percent interest in development of the deposit, which is being carried out under the name of *Compagnie Minière de L'Ogooué*. (*Comilog*). A railroad exists between Brazzaville and the coast port of Pointe Noire, but no facilities exist between Brazzaville and the mine, a distance of about 200 miles. Possibly, the firm is planning to build a rail line from the cable point to the main line, in addition to constructing the aerial tram.

UNION OF SOUTH AFRICA—By considerable changes in operating policy

and sorting techniques, particularly in respect to ensuring that only high-grade ore is fed to the mill, *Munnik Myburgh Chrysotile Asbestos Ltd.* effected a general improvement in its 1955/56 returns. Fibre extraction rose to 10.48 percent from 3.9 percent. This has permitted a reduced milling rate while maintaining fibre output at about 100 tons a month. Fibre color has been improved by converting the rotary drier from coal to oil burning.

FEDERATION OF RHODESIA & NYASALAND—*Chibuluma Mines Ltd.*'s operations are now fully launched, except for the cobalt plant. The company may produce up to 19,000 tons of copper in its first full year of production, a rate which is somewhat in excess of its estimated average rate of production due to higher than average grade in the upper sections of the mine which is now being developed. The cobalt plant, which is being constructed at Ndola, under the management of *Ndola Copper Refineries, Ltd.*, is now expected to begin operation in the middle of 1957. This plant consists basically of a Fluo-solids reactor and an electric furnace which will produce a cobalt matte containing about 10 percent cobalt which initially will probably be shipped to Europe for treatment.

LIBERIA—Discovery of a high-grade iron ore deposit in the north central province has been reported by the Liberian government. Development will be undertaken by a newly formed firm, organized by a Swedish bank, several Swedish industrial and mining concerns, a United States firm, and a Canadian company, according to the government. The Liberian government will hold a 50 percent interest in this new company. First step is to construct a 200-mile railway from the deposit to the coast where a new port would be built.

FEDERATION OF RHODESIA & NYASALAND—*Magundi Copper Mines and Minerals Ltd.* has reported that the full exploration of the 10,000 square miles of its *North Charterland Concession*, in which the promising copper deposits of the Myezi area are situated, is beyond its resources. Accordingly, it has concluded an agreement with the associate—*Anglovaal Charterland Exploration Company Ltd.*—of *Anglo-Transvaal Consolidated Investment Company Ltd.* and *North Charterland Exploration Company (1937) Ltd.* whereby all its concession rights are ceded to that associate for a cash consideration and participation rights in operations for development of mineral deposits in the Concession. The Anglovaal Charterland company has already started field work. Outside the Concession, the Magundi company will erect a plant to produce 300 tons of copper concentrates a month from its *Mtuga* mine, with output to be started early in 1957. Depending on securing its previous truck allocation, the company also plans the resumption of high-grade metallurgical chrome ore from its Southern Rhodesian mine.

UNION OF SOUTH AFRICA—Trial runs have been initiated in the uranium plant at *West Driefontein Gold Mining Company Ltd.* This plant will treat the residues from the gold plants of that mine and those from *Doornfontein Gold Mining Company Ltd.* Production proper should be in progress in the very near future.

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Lake, Delivered, destinations, U.S.A.	36.00¢
Foreign Copper, Valley basis	36.00¢
Custom	36.00¢
Common Grade, New York	16.00¢
Tri-State Concentrates, jig, flotation 80% lead, per ton	\$201.32
Prime Western: F.o.b. E. St. Louis	14.00¢
Prime Western; Delivered, New York	14.00¢
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Primary 30 Pound Ingots (99% plus), F.o.b. shipping points	27.10¢
Lens Star Brand, F.o.b. Laredo, in bulk (In ton lots) price per pound	\$2.25
Sticks and bars, 1 to 5 ton lots (Price per pound)	\$1.70
97.99% kg of 550 pounds (Price per pound)	\$2.35
Powder	Nom., per pound \$120.00
98% (per pound)	\$11.00-\$14.00
Carbonate	\$2.00¢
Ingots (99.8%) F.o.b. Valasco, Texas, per pound	36.00¢
Flasks, Small lots, New York	\$255.00-\$257.00
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99.3% + Grade "A" Sponge (Price per pound)	\$2.75
Nominal, per kilogram	\$4.00
Nominal, per kilogram	\$11.00
United States Treasury Price	\$35.00 per ounce
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Foreign Handy Harmon	91.37¢
Per Ounce	\$103.00-\$105.00
Sponge, Per Pound, Nominal	\$10.00
BERYLLOUM ORE:	
CHROME ORE:	
COLUMBIUM-TANTALUM ORE:	
IRON ORE:	
MANGANESE ORE:	
MOLYBDENUM CONCENTRATE:	
TUNGSTEN CONCENTRATE:	
URANIUM ORE:	
VANADIUM ORE:	
BENTONITE:	
FLUORSPAR:	
PERLITE:	
SULPHUR:	

ORES AND CONCENTRATES

10 to 12% BeO, F.o.b. mine, Colorado	\$45.00 per unit
Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection of \$400.00 per short ton or by assaying at: 8 to 8.9% BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$50.	
F.o.b. railroad cars eastern seaports. Long tons dry weight.	
African (Rhodesian), 48% Cr ₂ O ₃ , 3 to 1 Ratio	\$55.00-\$56.00
African (Transvaal), 48% Cr ₂ O ₃ , No Ratio	\$38.00-\$39.00
Turkish, 48% Cr ₂ O ₃ , 3 to 1 chrome-iron ratio	\$58.00
U. S. Government ore purchase depot Grants Pass, Oregon, Base price, lumpy ore, \$115.00; fines and concentrates \$110.00 for 48% Cr ₂ O ₃ and a 3 to 1 chromium-iron ratio. Premiums for higher grade are and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr ₂ O ₃ .	
At United States small lot beryl purchase depots. \$3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus. (Government stopped buying temporarily May 12)	
Per Pound Pentoxide.	\$1.15-\$1.30
Lake Superior, Per gross ton Lower Lake Ports	
Mesabi, Non Bessemer, 51.5% Fe.	\$10.85
Mesabi, Bessemer, 51.5% Fe.	\$11.00
Old Range Non Bessemer.	\$11.10
Old Range Bessemer.	\$11.25
Swedish, Atlantic Ports, 60 to 68% Fe. Contracts, Per Unit	\$22.00
Metalurgical grade, 48 to 50% Mn. Long ton unit	\$1.65
Metalurgical grade, 46 to 48% Mn. Long ton unit	\$1.55
Metalurgical grade, 44 to 46% Mn. Long ton unit	\$1.40
Domestic U. S. Government are purchasing deposits: Butte, Montana; (black and pink areas) base price of \$4.87 per long ton dry ton of 18% manganese ore. Phillipsburg, Montana; base price of \$6.43 per long ton unit of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40%, Mn. Base price per (48% Mn) \$2.30 per unit with premiums and penalties.	
90% Mn ₃ O ₄ f.o.b. Climax, Colorado. Per pound of contained molybdenum, plus cost of containers	\$1.10
Domestic, 60% WO ₃ Per short ton unit	\$55.00
Foreign, 65% WO ₃ Per short ton unit (Scheelite).	\$30.00
Foreign, South American, Spanish, Portuguese	\$29.00
Carnotite-Rosette, F.o.b. purchase deposit plus \$0.06 per ton mile (\$6.00 maximum), Grand Junction, Rifle, Durango, Naturita and Uravan, Colorado. Salt Lake City, Moab, Thompson, Moab, White Canyon, Green River and Monticello, Utah. Shiprock, and Grants, New Mexico, Edgemont, S. Dakota, Riverton, Wyoming, Taos City, and Carter, Arizona. Base price for 0.10% ore is \$1.50 per pound and up to \$3.50 per pound of contained U ₃ O ₈ plus \$0.75 per pound for each pound in excess of 4 pounds per short dry ton and an extra allowance of \$0.25 per pound for each in excess of 10 pounds. A \$0.50 per pound development allowance paid on all ore purchases. Special lime schedule applies at Monticello, Moab and Grants. No lime penalty with no vanadium payment or lime penalty with vanadium payment. Carnotite-Rosette, V ₂ O ₅ in ratio of more than 10 parts to 1 part of U ₃ O ₈ are generally acceptable at all AEC depots but excess not paid for at Marysville, Monticello, and Bluewater. Shiprock has no limit on V ₂ O ₅ to U ₃ O ₈ ratio and all contained V ₂ O ₅ is paid for	\$0.31

NON-METALLIC MINERALS

Minus-200-mesh, F.o.b. Wyoming points. Per ton in carload lots	\$12.50
Oil Well grade. Packed in 100 pound paper bags	\$14.00
Metallurgical grade, 70% effective CaO content per short ton F.o.b. Illinois-Kentucky mines	\$40.00
Mexican, 70% f.o.b. border	\$24.00-\$24.50
Acid Grade, 97% CaO, Bulk, F.o.b. Kentucky, Illinois, Colorado	\$55.00
Government buying f.o.b. producer's shipping point: 60% Illinois-Kentucky, \$34.50 per ton, others \$28.50, 70% Ill.-Ken. \$38.50, others \$32.50.	
Crude, F.o.b. mine per short ton	\$3.00 to \$5.00
Pastes grades. Crushed and sized, F.o.b. plants	\$7.00 to \$9.00
Long ton, F.o.b. Hoskino Mound, Texas	\$25.50
Export	\$3.50

LONDON METAL AND MINERAL PRICES

	December 19, 1956
	Per Long Ton USA Equivalent cents per pound ¹
COPPER:	
Electrolytic spot	£273 0s 0d 34.12¢
Refined 99%	£114 0s 0d 14.25¢
Virgin, 98%	£99 10s 0d 12.44¢
ZINC:	
Ingot, 99.5%	£197 0s 0d 24.625¢
Regulus, 99.6%	£222 10s 0d 27.81¢
TIN:	
Standard, 99.75%	£801 0s 0d 100.13¢
TUNGSTEN:	
Long ton unit 225.5	£31.50

With Sterling pound at \$2.80.

Quotations on metals and certain ores through the courtesy of American Metal Market, New York, N. Y.

1956 Review

Continued from page 52 (WM40) mills, was faced with difficult terrain and mill site problems decided to follow a similar pattern as Pronto. That is, pump mill pulp uphill for gravity treatment and tailing flow rather than pump in the mill proper and to tailing disposal. After fine grinding, the feed pulp will be pumped to a separate building 2,500 feet way and 300 feet higher.

The *Metal Miner's Hope for 1957* is for early approval by the 85th Congress of necessary funds, already authorized, to carry out the purchasing program authorized by Public Law 733, 84th Congress, (The Minerals Purchase Act of 1956). This law calls for purchase of domestic tungsten, asbestos, fluorspar, and columbite-tantalite through December 1958. The appropriation bill rushed through 84th Congress provided for only limited funds; in fact so limited were the funds allocated to tungsten that they had all been used by early December 1956.

The uranium industry hopes for clarification and assurances about the United States Atomic Energy Commission's uranium procurement program after 1962. Specifically: What does AEC mean by statement limiting concentrate purchases to 1,000,000 annual pounds of U₃O₈ from "any one mining property or mining operation."

What the *underground miners' need most in 1957* is a simple, low cost, portable gun that will drive permanent anchor bolts into the hardest rock in the back and ribs. A gun similar to the everyday stud gun that drives permanent pins into concrete and steel. The underground anchor gun would find immediate use in placing supports for pipe, vent lines, trolleys, electric cable, etc.

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- 1—Coppus-Ventair Blower, Type TM Size 6
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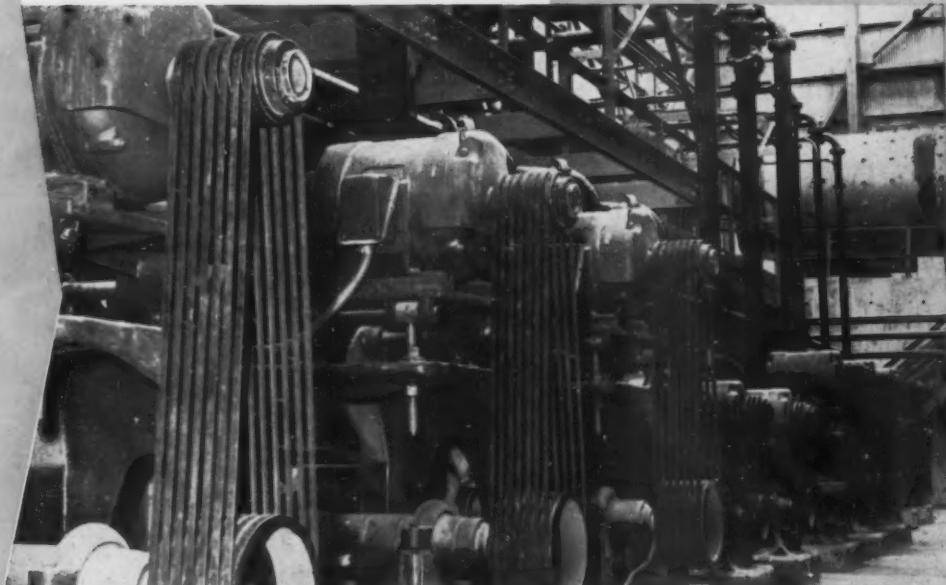
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